Environmental perspective towards sustainability (environmental knowledge of university students in Greater Jakarta)

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Abstract. Human perspective on the environment is influenced by factors, education, economic status, and the living environment. This study aims to link environmental knowledge (EK) held by university students and their sustainable behaviour in greater Jakarta. This research is based on the hypothesis that there is no significant relationship between knowledge and pro-sustainability behaviour. A survey was conducted for 50 university students in greater Jakarta, followed by an analytical descriptive to process the data. Research result shows that respondents who hold high Environmental Knowledge are less than respondents who obtain below average Environmental Knowledge. Moreover, it shows no relationship between knowledge and sustainable behaviour. Insights from this study will inform a higher level of environmental knowledge does not necessarily lead to more positive attitudes and behaviors regarding sustainability.

1 Introduction

Technological advances, unsustainable consumption, and increasing global population have led to significant environmental degradation and disasters [1]. Ehrlich & Ehrlich noted that "But today, for the first time, humanity's global civilization—the worldwide, increasingly interconnected, highly technological society in which we all are to one degree or another, embedded—is threatened with collapse by an array of environmental problems" [2]. There are many problems, and these problems can cause and interfere with environmental sustainability such as climate change, ozone depletion, one of which is due to the cumulative effects of everyday human activities [3]. Sharing information to respect different perspectives and work together is very important to achieve mutually beneficial goals in cities and other communities where environmental problems develop [4]. According to Ainley & Ainley, social interaction is gained by cultural traditions, values, and practices [5].

The world views humans as are an integral part of the earth; instead, overpower the earth is challenged by sustainability[6]. Our ability to survive, global production continues without waste [7], especially for environmental boundaries to be achieved and targets for quality of life [8], without negatively affecting future populations while current needs are met. Jakarta, Indonesia's capital city, faces many environmental issues, including decreasing water quality,

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which led to the degradation of the coral reef in its Bay [9]. Moreover, pollution in its two major rivers is evident [10,11]. Jakarta is chosen as a case study for two key reasons. Firstly, Jakarta is the capital city of Indonesia. Secondly, the location of Universitas Indonesia is Indonesia's top institution located in the greater Jakarta region (Jakarta and Depok). The author argues that environmental knowledge (EK) of postgraduate students from Indonesian universities is considered high. The author's statement is justified from the research of Aminrad et al., which states that increasing levels of education followed by increasing age has an effect on increasing environmental awareness [12], as well as by Philippsen et al. which states that humans who have higher education tend to have a higher degree of the environment than individuals with lower education [13]. Research results can be used as pioneering research in measuring the level of environmental awareness in sustainable behaviour for the local government. Environmentally consciousness means not enough to know what the environment is and understand how the environment works, including taking action to support the environment. For this reason, the authors want to show whether knowledge about the environment can influence behaviour for sustainable living.

1.1 Sustainability and sustainable behaviour

Economic, environmental, and social are three dimensions of sustainability to underlie development [14]. The sustainability concept requires us to calculate the reduced environmental degradation [15]. All problems that have been mentioned can be reduced if humans have behaviors for sustainable living. That behavior should be shared by all people regardless of where they live and their education level. Sustainable behavior is an act of protecting the natural and human (social) environment, which is practically synonymous with "pro-environmental behavior, which is used to emphasize protecting the natural environment[16], but sustainability cannot be achieved if humans do not move from now to have sustainable behaviour. The author takes the research subject of graduate students to assume that they have sufficient knowledge about the environment. Citizen engagement on climate change and sustainability issues is also a frequent challenge, including the number of barriers to engagement that are well documented [17].

1.2 Environmental knowledge

The thinking skills development of Indonesian people is one of the strategic positions to build an independent and accountable national character [18]. "Humans are the critical players concerning the conservation and sustainability of the environment and natural resources. Their awareness of different environmental issues is an influential factor that directs their responses to and interactions with their environment and is shown less by unemployed people (including homemakers) than students and working citizens [19]. Concepts and issues knowledge helps people to take action for change in their communities [20]. Environmental knowledge understands the biophysical environment and its problems, including familiarity and awareness of the environment itself [21, 22]. Environmental knowledge also includes general knowledge related to concepts, facts, the relationship between the natural environment and the main ecosystem, and an understanding of ecological processes[23]. Following this concept, the authors argue that individuals must have EK.

Attitude towards the environment, including the environmental learning process, can be caused by environmental problem awareness [24] and owned by people with a higher EK [25,26]. This statement is in line with Robinson & Cole, which provides a statement in which scientific knowledge of human and natural systems has a vital role to play as input for political, ethical, and normative decisions for the future to be created. [27]. Knowledge,

knowledge of effectiveness, and knowledge related to actions are three dimensions of EK following Liefländer & Bogner [28]. Meanwhile, other researchers defined EK's domains as effectiveness, procedural, and declarative knowledge [29], and scaled by action-oriented problem solving abstract concepts and factual knowledge [30].

1.3 Sustainability in the higher education perspective

According to Birdsall, knowledge about an uncertain future can gain deeper sustainability understanding [30]. Different residential environments have an essential role in explaining fundamental values in knowledge, attitudes, and behavior [30]. Besides, success in previous education, parental education, age, extracurricular activities, and the campus where they study influenced students' perceptions of higher education [31]. Higher education plays a role in promoting sustainable development [33] and increasing knowledge, awareness, values, and skills as a moral responsibility for a sustainable and just future [34]. The involvement of higher education is also crucial for the application of related sciences to be applied in everyday life [35]

Consumption behaviour habits can determine environmental awareness. Research conducted by Riskalla et al. on students sustainable consumption behaviour from a psychological perspective found that the norms and values influence sustainable consumption behaviour in the surroundings where the individual does activities[36]. This statement is in line with behaviour that can be influenced by persuasive communication from the surroundings and active participation [37]. The formation of a sustainable future for society is an essential function of environmental preservation practices in universities [38]. One of the practices is evaluating sustainability, which will develop students' understanding of sustainability in their community [39], where the university has developed the concept of sustainability and incorporated it into their curriculum [40]. Assuming that students have limited environmental knowledge and a simple disposition to environmental protection, the practice of measuring environmental competence is very important both individually and at the cohort level [41]. Hensley explains that promote sustainability, and students must be equipped with self-management to increase community resilience and advance [42]. Extensive literature has highlighted the importance of the support of this research theory.
Nonetheless, there is a gap in the level of education in terms of EK. This present study aims to fill this gap by investigating whether knowledge about the environment influences sustainable living behaviour. Graduate students are the research subjects with the assumption that they have sufficient knowledge about the environment.

2 Method

The approach used in this study is quantitative. This study uses a purposive sampling technique that takes a group of postgraduate students from the University of Indonesia who live in the Jabodetabek area or Greater Jakarta. Online questionnaire survey conducted with a total sample of this study was 50 students taken randomly from the two campus locations. The short duration of the study and limited resources made the sample in this study small. The online questionnaire asks students to fill out a questionnaire consists of demographic data, including domicile, gender, campus origin, majors. Respondents come from several majors and have different environmental backgrounds. The survey questions itself that contain ten multiple-choice cognitive questions related to the environment and the problems. The author adopted some of these questions from previous researches [43, 44, 45]. Besides, 14 survey questions related to daily behaviour that reflect environmental care and sustainability were given and adapted with a slight modification from previous research.

3 Result and discussion

To assess EK, the author uses ten environmental problem questions asked in multiple choices with four choices of answers with a correct score of 1, and the answer score incorrectly worth 0. This question is shown in Table 1.

Table 1. Environmental knowledge questionnaire questions.

No.	Question
1	The most abundant component of air in the atmosphere
2	Why is carbon monoxide gas very dangerous to the human body?
3	Definition of biotics
4	Compound that functions as a UV ray filter
5	Definition of ecosystem
6	The function of reforestation in a big city
7	Substances that can cause air pollution
8	The sign on river water that has been polluted
9	Why the lake surface that covered by water hyacinth will cause the biota underneath it cannot live
10	Plants that function in the ecosystem, not as producers

The survey results on 50 respondents are presented in Table 2.

Table 2. Frequency analysis of environmental knowledge percent result.

Q					
		Frequency	%	Valid %	Cumulative %
Valid	2	1	2.0	2.0	2.0
	7	8	16.0	16.0	18.0
	8	19	38.0	38.0	56.0
	9	9	18.0	18.0	74.0
	10	13	26.0	26.0	100.0
	Total	50	100.0	100.0	

From the results of a survey on general knowledge of the environment, it can be seen that 26% of respondents answered all questions correctly (score 10), 18% answer nine correct questions (score 9), 38 percent answer eight questions correctly (score 8), 16% answer seven questions correctly (score 7), and 2% answer two questions correctly (score 2). Most respondents incorrectly answered the number of questions was question number 7, as much as 54% of respondents wrong, number 10 with 40% of respondents wrong, and number 1 with 34 respondents wrong. The average score from the results of this environmental knowledge survey is 8.42. From this average result, the author divide respondents into two groups, namely respondents with high Environmental Knowledge, namely respondents who get scores above the average with 22 respondents (44%), and low Environmental Knowledge, namely respondents who get below average with 28 respondents (56%) in the result. The results obtained in this questionnaire do not support the author's argument, which states that the environmental knowledge of postgraduate students is considered high, as previously mentioned, likewise with the statement from Aminrad et al. and Philippsen et al., which states

that a higher level of education affects environmental awareness. This difference in opinion is probably due to the different conditions and learning situations of the respondents. The author has not provided further justification related to the influence of the surrounding environment, including the respondents' background, due to the limited information that the authors get from this study.

There are 14 statements about pro-environment attitudes and behaviours with the Never rating scale with the weight of point 1, Seldom with 2 point, Sometimes with the weight of point 3, Often with the weight of point 4 and Always with the weight of point 5 while the survey results for 50 respondents are as follows. Of the 50 respondents, there were four people (8%) who had never sorted out the rubbish, seven people (14%) who seldom sorted out their waste, 24 people (48%) who sometimes sorted their rubbish, 13 people (26%) who often sorted the rubbish, and two people (4%) who always sort the rubbish. The survey results for this behaviour were 3.04, with a standard deviation of 0.947. For the behaviour of, I buy second hand (e.g., clothes, furniture, etc.), nine people (18%) never bought used goods, 19 (38%). People rarely buy second-hand goods, 15 (30%) sometimes buy used goods, seven people (14%) often buy used goods, and no one chooses always to buy used goods. The survey results for the second-hand buy behaviour (e.g., clothes, furniture, etc.) averaged 2.40 with a standard deviation of 0.948. For behaviour "I talk with my family or friends about the current environmental situation," it found that 12 people (24%) rarely talked about the current situation related to the environment, 16 people (32%) sometimes discussed the current situation related to the environment, 17 people (34%) often talk about the current situation relating to the environment, five people (10%) always talk about the current situation related to the environment. No one has never discussed the current situation relating to the environment with an average of 3.30 is obtained with a standard deviation of 0.953. Of the 50 respondents, no one has never saved water, 16 people (32%) respondents always save water, 12 people (24%) often conduct water-saving behaviour, 19 people (38%) sometimes save water, and three people (6%) rarely water-saving behaviour. The "I try to save water" behaviour question obtained an average of 3.84 with a standard deviation of 0.962.

This "I attend activities about sustainable development behaviour includes lectures on building construction, seminars, workshops, conferences, and others", there are three people (6%) who always attend activities related to sustainable development. Meanwhile 12 people (24%) often attend activities related to sustainable development, 18 people (36%) sometimes attend activities related to sustainable development, 13 people (26%) rarely attend activities related to sustainable development, and four people (8%) never attend activities related to sustainable development. This "I attend activities about sustainable development" behaviour survey obtained an average of 2.94 with a standard deviation of 1.038. With an average of 2.7 and a standard deviation of 0.863, related to behavior "I print reading materials from my computer" there is one person (2%) who always prints reading material from a computer. Eight people (16%) often print reading material from their computers, 18 people (36%) sometimes print, 21 people (42%) rarely, and two people (4%) who print no reading material from their computers. For now, there is many campaigns about reuse or reuse products that have used and reduced disposable products. However, based on the survey results of the behavior of "I use disposable products", there are only two people (4%) who have never used disposable product, 13 people (26%) rarely use, 31 people (62%) sometimes use, three people (6%) who often use and one person (2%) who always uses disposable products. Related to the behaviour of using disposable products got an average of 2.76, with a standard deviation of 0.716. The addition of mass transportation modes is intensively carried out in the Greater Jakarta area with the construction of LRT (Light Rapid Transit) and MRT (Mass Rapid Transit), which are increasingly increasing the choice of mass transportation modes already available in Greater Jakarta (Commuter Line or KRL and Trans Jakarta or BRT). Related to the results on public transportation use survey results, 11 people (22%) always using mass

transportation. The percentage of respondents who often and sometimes used was the same. Namely 16 people (32%), and seven people (14%) never used public transportation. In connection with the respondents who have never used public transportation, they can assume that they use private transportation. And it can be assumed that the distance between activities and living places is close and can be reached by walk.

The behaviour "I have changed my lifestyle to reduce waste (e.g., throwing away less food or not wasting materials)". From the survey results on lifestyle changes to reduce waste, seven people (14%) always or have done, and the remaining 43 people (86%) are changing lifestyles, and no one never has or has not changed the behaviour of reducing waste. The survey to change the behaviour of reducing this waste got an average of 3.6, with a standard deviation of 0.857. The availability of trash cans in private areas such as homes or rooms or public spaces affects the behaviour of someone's willingness to pick up trash and throw it in the trash. The results showed that nearly 38% of respondents sometimes picked up rubbish when they met him, and no one never picked up rubbish when he saw it. The author states that this is very reasonable because this behaviour is influenced by the waste they encounter. If the rubbish is practical enough to carry and is not a hassle, they will immediately pick it up. For this behaviour, an average of 3.36 is obtained with a standard deviation of 0.964. Many companies think about taking part in protecting the environment. This is because of the large number of customers who realize that companies have responsibility for the packaging of their products. The campaign to reduce plastic packaging is also being implemented intensively, with 36% of respondents already aware of the importance of companies responsible for the packaging of the products they produce, 32% percent who often think about this. This behaviour is influenced by the customer's attitude who seeks comfort in consuming and using a product and thinks about the sustainability of the environment in terms of what they consume. The average value of the survey on the company's behaviour awareness on its products' packaging is 3.96, with a standard deviation of 0.968.

The amount of information about companies that do not pay attention to their employees' welfare, use underage children, and corporate behaviour that does not pay attention to the environment contributes to growth community attitudes in behaviour avoid buying and using products from the company. 40% of respondents often avoid using products from these companies, and 8% of respondents always avoid them. The survey of behaviour to avoid companies that damage the environment is 3.32, with a standard deviation of 0.957. The behaviour of recycling unused items also seems not to become a habit of postgraduate students. Only 8% of respondents always do it, and 18% often recycle used goods with an average survey result of 2.96 with a standard deviation of 0.968. 40% of respondents have realized and always think that there are actions and needs that they will damage the natural environment. Also, 28% of respondents often think that their actions will damage the natural environment. There are so many factors that influence this attitude. The increasingly dynamic pressure of need also influences that attitude. This survey of awareness attitudes obtained a standard deviation of 1.068, with an average of 2.04.

The hypothesis used for analyzing the relationship between the level of knowledge and pro-sustainability behaviour is as follows:

a. Ho: There is no significant relationship between the level of knowledge and pro-sustainability behaviour
b. Ha: There is a significant relationship between the level of knowledge and pro-sustainability behavior.

Pearson chi-square analysis was used with Asymp. Sig. > 0.05, then Ho accepted, and if Asymp. Sig. <0.05 then Ha accepted. The following is an analysis of the relationship between the level of knowledge and pro-sustainability behaviour.

Table 3. Relationship of behaviour statements with environmental knowledge.

No.	Statements	Asymp. Sig.	H0/Ha
1	I sort my waste.	.429	H0
2	I buy second hand (e.g., clothes, furniture, etc.)	.408	H0
3	I talk with my family or friends about the current environmental situation	.347	H0
4	I try to save water; for example, when I take a shower	.421	H0
5	I attend activities about sustainable development (e.g., lectures about sustainable development)	.305	H0
6	I print reading materials from my computer.	.201	H0
7	I use disposable products.	.823	H0
8	I use public transportation.	.518	H0
9	I have changed my lifestyle to reduce waste (e.g., throwing away less food or not wasting materials).	.815	H0
10	I pick up rubbish when I see it out in the countryside or public places.	.557	H0
11	I think that companies have a responsibility to reduce the use of packaging and disposable articles	.620	H0
12	I avoid buying goods from companies with a bad reputation for looking after their employees and the environment	.753	H0
13	I recycle as much as I can.	.048	Ha
14	I don't think about how my actions may damage the natural environment.	.019	Ha

From Table 3, the results obtained in the large part state that there is no significant relationship between the level of knowledge and pro-sustainability behaviour. But Robelia & Murphy states that "Environmental knowledge surveys do not assess the level of conceptual understanding necessary to make sense of facts; however, they may be indicators of what conceptual ecologies the public has to incorporate new information into their environmental understanding" [46]. However, Liefländer & Bogner argue that different actions will affect effectiveness knowledge [28]. This study also contradicts the research from Polonsky et al., which states that generally, environmental knowledge is related to attitudes, and specifically, behavior is driven by attitudes towards the environment [47]. The study findings from Mohiuddin et al. also do not support this research, wherein Mohiuddin's study emphasized that environmental knowledge and awareness of consequences have a positive and significant effect on student attitudes toward the environment [48]. Other research states that Environmental knowledge is directly related to Environmental concern, which shows that higher awareness of the environment is owned by those with extensive knowledge of environmental issues [23].

4 Conclusion

The results show no relationship and difference; therefore, the hypothesis formulated at the beginning of the writing is rejected. Furthermore, a higher level of environmental knowledge does not necessarily lead to more positive attitudes and sustainability behaviours. So, students with higher Environmental Knowledge levels did not differ in their attitudes from students with lower Environmental Knowledge levels, and there were only a few differences in behaviour involved by the two groups involved. Furthermore, there is only a weak relationship with the relationship between attitudes and behaviour. This research was conducted with respondents from postgraduate students located in the Greater Jakarta area. A larger number shown by a group with common environmental knowledge cannot be used as justification and a reflection of the quality of the related respondent institution's

environmental awareness because this environmental knowledge shows more about the individual's quality in carrying out his daily environmentally friendly behaviour. An environmentally friendly attitude can be enhanced through habituation, which is strengthened by the existence of strict regulations from the institution in behaving in an environmentally friendly manner and the living conditions of the individual concerned. If the environment around the individual has good habits to be environmentally friendly, that individual will be environmentally friendly. There is still much that needs to be developed from the research conducted by the author. The authors suggest that future research needs to be carried out with a broader demographic range, including the level of study, residence area, and others according to their needs. Development is carried out to find new changes, especially those related to sustainable living, environmental management, deep environmental awareness, and stronger correlation. And the role of teachers, lecturers, and the educational environment also needs to be conducted following the statements of Barraza & Cuarón that the teacher's role and the school's ethos play vital roles in the development of the four elements of environmental education: values, and attitudes, knowledge, and actions [49].

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References

1. B. Chekima, S. Chekima, Syed Azizi Wafa Syed Khalid Wafa, O. A. Igau, S.L. Sondoh, IJSDWE, **23**, 210–220, (2015)
2. P.R. Ehrlich, A.H. Ehrlich, *Proceedings of the Royal Society B: Biological Sciences*. 280, (2013)
3. S.B. Abbott, L. Sigman, Our Common Journey: a Transition toward Sustainability, National Academy Press, (1999)
4. J. Fraser, R. Gupta, M.E. Krasny, EER,**21**, 777–800, (2014)
5. M. Ainley, J. Ainley, IJSE,**33**, 1, 51–71, (2011)
6. P. Walker, EH, **16**, 93–98, (2017)
7. H.D. Schneider, I.E. Livitz, D. Schneider, JOTSC, **10**, 124–147, (2013)
8. J. Gibberd, BRI, **43**, 49–61, (2014)
9. G. Baum, H.I. Januar, S.C.A. Ferse, A. Kunzmann, PO, **10**, 9, (2015)
10. S. Amira, W. Astono, D. Hendrawan, *IOP Conference Series: Earth and Environmental Science*, **106**, 012023, (2018)
11. P.A. Permatasari, Y. Setiawan, R.N. Khairiah, H. Effendi, *IOP Conference Series: Earth and Environmental Science*, vol. **54**, 012026, (2017)
12. Z. Aminrad, S.Z.B. Zakaria, A.S. Hadi, TSC, **6**, 15–19, (2011)
13. Philippsen, J. S., Angeoletto, F. H. S., & Santana, R. G, EA **27**, 1, 039-044, (2017)
14. N.S.C. Issa, S.D.A. Abbar, IJSBTUD **6**, 34–38, (2015)
15. A.U. Sarkar, IJSDWE, **5**, 164–171, (1998)

16. C. Tapia-Fonllem, V. Corral-Verdugo, B. Fraijo-Sing, M. Durón-Ramos, Sustainability, **5**, 711–723, (2013)
17. K. Revell, JIES, **10**, 199–218, (2013)
18. E. S. Manapa, JPP, **11**, 1, (2010)
19. S.M. Al-Balushi, S.S. Al-Aamri, IRGEE, **23**, 3, 213–227, (2014)
20. L. Down, AEEC, **14**, 105–111, (2015)
21. L.T. Cheung, L. Fok, E.P. Tsang, W. Fang, H. Tsang, EER, **21**, (2014)
22. G. E. Fryxell, C. W. Lo, *In 10th international conference of the Greening of Industry Network*, 1-35, (2015)
23. J. Heo, S. Muralidharan, JMC, **25**, 421–437, (2017)
24. T. Arcury, HO, **49**, 4, 300–304, (1990)
25. L.M. Dechano, IRGEE, **15**, 15–28, (2006)
26. T.S. Emiru, D.K. Waktola, IRGEE, **27**, 216–233, (2017)
27. J. Robinson, R.J. Cole, BRI, **43**, 133–143, (2014)
28. A.K. Liefländer, F.X. EER **24**, 611–624, (2016)
29. N. Carmi, S. Arnon, N. Orion, TJEE, **46**, 183–201, (2015)
30. T. Braun, R. Cottrell, P. Dierkes, EER, **24**, 6, 899–920, (2017)
31. S. Birdsall, EER, **20**, 6, 814–835, (2013)
32. H.S. Akareem, S.S. Hossain, ORER, **3**, 1, 52–67, (2016)
33. C. Tapia-Fonllem, B. Fraijo-Sing, V. Corral-Verdugo, A.O. Valdez, *SAGE Open*, **7**, (2017)
34. A. D. Cortese, PHE, **31**, 3, 15-22, (2003)
35. R. Torres, R.M. Vieira, A.V. Rodrigues, P. Sá, G. Moreira, IJSHE, **18**, 956–970. (2017)
36. Rizkalla, Nosica, et al., *Proceedings of the 2019 International Conference on Organizational Innovation (ICOI 2019)*, (2019)
37. M. Fishbein, I. Ajzen, Belief, attitude, intention, and behavior: an introduction to theory and research, Addison-Wesley, (1975)
38. A. Hoque, A. Clarke, T. Sultana, EDS, **19**, 2163–2180, (2016)
39. E. Davey, JESS, **7**, 540–549, (2016)
40. S. Holdsworth, I. Thomas, JESD, **9**, 137–159, (2015)
41. K. Shephard, J. Harraway, B. Lovelock, S. Skeaff, L. Slooten, M. Strack, et al., EER, **20**, 476–495, (2013)
42. N. Hensley, JSE, **13**, (2017)
43. T. Berglund, Student'sustainability consciousness' and decision making on sustainability dilemmas: Investigating effects of implementing education for sustainable development in Swedish upper secondary schools (2014) (Doctoral dissertation, Karlstads Universitet)
44. K. Sammalisto, A. Sundström, R.V. Haartman, T. Holm, Z. Yao, *Sustainability*, **8**, 510, (2016)
45. A. Rahmah, New Edition Big Book Biologi SMA Kelas X,XI & XII, Cmedia, (2017)
46. B. Robelia, T. Murphy, EER, **18**, 299–321, (2012)

47. M.J. Polonsky, A. Vocino, S.L. Grau, R. Garma, A.S. Ferdous, JMM, **28**, 238–263, (2012)
48. M. Mohiuddin, A.A. Mamun, F. Syed, M.M. Masud, Z. Su, *Sustainability*, **10**, 1534, (2018)
49. L. Barraza, and A.D. Cuarón, JBE, **39**, 1, 18–23, (2004)