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CONSERVATION BEHAVIOR OF PLANT BIODIVERSITY: SUPPORTING ENVIRONMENTAL SUSTAINABILITY

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Abstract: This research aims to describe the plant biodiversity conservation behavior among university students that may differentiate between the work of natural science students and their social science peers. It was conducted through an online questionnaire involving universities around Jakarta, Indonesia. The instrument in this study contained statements regarding conservation behavior towards plant biodiversity. The instrument indicators were based on the principle of Conservation Law No. 5 of 1990, namely 1) Protection, 2) Preservation and 3) Utilization. All items in the instrument had been shown to be valid and reliable. The data was analyzed descriptively. The results indicated that students, in general, had good response to plant biodiversity conservation behavior. The plant biodiversity conservation behavior was in a good category, although the natural science group was better than the social science group. University students also had the same average percentage in each conservation indicator. It is important to improve the conservation behavior of plant biodiversity to maintain environmental sustainability. This research indicates that social science students must also learn to appreciate conservation behavior like their natural science peers to ensure better environmental sustainability.

Keywords: Biodiversity, conservation, plant, behavior.

Introduction

Indonesia is a country with substantial biodiversity in Asia. However, the problem with environmental conservation, such as the high extinction rate of plant species, is also huge in the country. According to records, there are 240 plant species that have been declared as rare, and 36 more, especially trees, have gone extinct (Kusmana & Hikmat, 2015). This is due to overexploitation of natural resources and the lack of public awareness on the importance of plant diversity (Fauzi & Fariantika, 2018; Zhao *et al*., 2018).

One solution that may overcome the problem of reduced plant biodiversity is preservation of the environment and the conservation of its resources (Markaki, 2014). Conservation behavior also needs to be instilled in various groups, not only in the form of knowledge, but also actions that are commonly known as conservation behavior to maintain environmental sustainability (Avan *et al*., 2011; Komala *et al*., 2020; Rahmayanti, *et al*., 2020; Suharini, *et al*., 2020; Suharini, *et al*., 2020).

Among those who still have many opportunities to practice plant diversity conservation behavior are school and university students. They are a generation that is still very enthusiastic about environmental issues, and will willingly adopt conservation behavior for future wellbeing (Avan *et al*., 2011). Although their opportunities are quite numerous, it is uncertain whether their conservation behavior towards plant diversity may be implemented successfully. This issue is particularly important among university students because they may be categorized into two groups based on their studies, namely natural science (NS) and social science (SS). NS and SS students have different approaches in education, where NS students study biodiversity subjects in a scientific manner, while SS students focus more on community issues. This difference is a unique thing to study because university students play an important

role in promoting environmental sustainability. Teachers as a facilitator must conduct their lessons with a contextual topic about the environment. This topic can improve students' behavior towards protecting biodiversity in the environment. A good environment will ensure human survival and well-being for many generations (Azrai *et al*., 2019; Mamun *et al*., 2020; Sigit *et al*., 2019).

Several studies on protecting the environment in accordance with sustainable development programs have tried to describe various needs in terms of facilities and infrastructure (Miarsyah *et al*., 2019; Russo *et al*., 2016). In addition, efforts have been made to develop various technology-based learning media to improve the students' ability in overcoming various environmental problems (Boholano, 2017; Ichsan *et al*., 2020; Miarsyah *et al*., 2019; Purwanto *et al*., 2020; Saltan & Divarci, 2017; Sigit *et al*., 2019). Another effort to improve students' ability and behavior in overcoming environmental problems is by developing an environment-based education model to empower sustainability (Beattie, 2015; Rahmayanti *et al*., 2020; Sigit *et al*., 2020). One way of doing so with regard to plant preservation efforts is through the development of teaching materials based on the concept of plant growth and development (Supriyatin *et al*., 2019).

Various efforts have been made to teach students how to overcome science and environmental problems (Ichsan & Rahmayanti, 2020; Komala *et al*., 2020; Paristiowati *et al*., 2019; Sahronih *et al*., 2019; Suryanda *et al*., 2020) especially to solve environmental problems when COVID-19 pandemic. This was to develop a new level of thinking, namely Higher Order Thinking Skills of Environmental Problem (HOTSEP. Based on this explanation, this research is a novelty because there have been no studies describing conservation behavior of students in an attempt to increase awareness on plant biodiversity. The study of conservation behavior among the younger generation is urgent because there are many environmental problems that must be resolved.

Given the low likelihood that students will apply conservation behavior on plant biodiversity, this study has created a learning medium to introduce the subject. Through adequate knowledge, it is hoped that the students may improve their behavior (Suryanda *et al*., 2020). Studies on biodiversity mostly covered biological perspectives. There are not many studies that discuss conservation behavior itself, especially from the NS and SS students' point of view. The aim of this research is to analyze the conservation behavior on plant biodiversity and compare it between NS and SS students.

Method

This research was a descriptive study conducted from April to May 2020. A total of 200 undergraduate students consisting of 100 NS and 100 SS students from several universities in Jakarta, Indonesia, were recruited to answer a questionaire. The subjects were chosen by simple random sampling from several programs of study at the respective universities. Google Form was chosen as the survey instrument because data collection had to be collected online due to the Covid-19 pandemic. The instrument was divided into multiple choice and "agree-disagree" components. The multiple choice instrument contained statements to gauge the students' conservation behavior and knowledge on plant biodiversity, while the agree-disagree instrument provided insight into their opinion on the subject.

The contents of the instruments were developed from the principle of conservation based on Law No. 5 of 1990, namely: 1) Protection, 2) Preservation and 3) Utilization, and the development of an equivalent biodiversity concept for undergraduate students. The multiple choice instrument used a 1-5 score, whereas the agree-disagree instrument used a 0-1score. The validity and reliability tests had previously been conducted on the instrument. The results showed that all items were valid and reliable. The data of students' conservation behavior on plant biodiversity were analyzed descriptively using tables, while t test was used to compare the differences between NS and SS students ($P<0.05$).

Results and Discussion

This research produced several analysis tables. The first was the percentage of conservation behavior knowledge between NS and SS students. The differences between the students could be seen on Table 1.

Based on Table 2, NS students had higher percentage (56.7%) of conservation behavior than their SS peers (46.3%). This indicated that NS students were more involved and had better knowledge in conservation behavior.

Table 1: Percentage of conservation behavior and knowledge on plant biodiversity between natural science and social science students

Number of Item	Statement	NS (%)	SS (%)	Difference (%)
1	Knowing the extinction status of plants	53.3	46.7	6.6
2	Supporting constitution on plant conservation	52.8	47.2	5.6
3	Prohibiting destruction of plants	70.4	29.6	40.8
4	Giving criticism and suggestions to improve awareness about plants	52.7	47.3	5.4
5	Planting in own garden / home	53.4	46.6	6.8
6	Sharing information about plant benefits	54.8	45.2	9.6
7	Trying to protect plants	52.2	47.8	4.4
8	Sharing information about plant protection	54.2	45.8	8.4
9	Active in plant conservation programs	54.8	45.2	9.6
10	Introducing plant biodiversity to others	55.2	44.8	10.4
11	Paying attention to everything about plant conservation	66.8	33.2	33.6
12	Collecting unique plants	66.4	33.6	32.8
13	Knowing the characteristics of plants	56.2	43.8	12.4
14	Following rules on plant conservation	68.6	31.4	37.2
15	Exploiting plants for own happiness	68.7	31.2	37.5
16	Donating money for plant conservation	53.9	46.1	7.8
17	Selecting real samples of plants for study purposes	69.1	30.9	38.2
18	Always helping to sustain plant life	69.7	30.3	39.4
19	Always preserving and encouraging plant conservation efforts.	70.7	29.3	41.4

Table 2: Percentage of conservation behavior between natural and social science students

Group Category	Percentage
Natural Science	56.7
Social Science	46.3
Total	100

Table 3 shows the differences between NS and SS students compared using the t test. The results indicated that the conservation behavior between the two groups was significantly different.

Referring to Table 4, the percentage of conservation behavior based on the three dimensions suggested that protection had the highest percentage, followed by preservation and utilization.

Table 3**:** The Comparison of conservation behavior between NS and SS students

					95% Confidence Interval of the Difference	
	T	Df	Sig. (2-tailed)	Men Difference	Lower	Upper
NS	133.755	99	.000	78.630	77.46	79.80
SS	57.164	99	.000	53.190	51.34	55.04

$p<0.05$

Table 4: Percentage of conservation behavior in plant biodiversity dimensions

No	Dimensions	Percentage
1	Protection	36,82
2	Preservation	30,89
3	Utilization	32,28
Total		100

This study also explored conservation behavior between male and female students as shown in Table 5. Female students seemed to have higher score (81.66%) than males (71.14%). In this case, female students were more attentive to the environment and conservation.

Table 5: Comparison of scores between male and female students' conservation behavior towards plant biodiversity

Gender	Respondents	Mean Score
Male	100	71,14
Female	100	81,66

The students' opinion was collected through a case statement and response, which asked them to agree or disagree with the answer. The instrument was deliberately made with statements having the "disagree" option as the good answer. Table 6 shows that any students agreed with the first two statements. This result showed that for problems No. 1 and 2, many students had missed the concept of biodiversity.

Table 6: Students' opinion on case statements (n=200)

No	Item	Agree (person)	Disagree (person)
1	Exchange of plants between countries can increase plant diversity.	146	54
2	Consuming rice as a staple is an effort to maintain the presence of rice plants.	144	56
3	The herbal medicine industry is actually less profitable because it takes a long time to cure a disease and requires large area to grow herbs.	45	155
4	Rare plants are not a great concern as now we can learn about them through virtual learning.	19	181
5	Horticultural plants that do not sell on the market do not need to be preserved because they are unprofitable and cost a lot of money to grow.	30	170
6	The "Green Open Space" (RTH) has been reduced by the development of houses along riverbanks, which is also very important.	35	165

Table 7 shows that although items No. 1 and 2 were not well responded, all items obtained a similar percentage. There were no items with an extreme percentage among the six problems in conservation behavior.

Based on the agree-disagree instrument, the data were analyzed in two categories. In Table 8, it was found that students with good conservation behavior (58.5%) were higher than the fair group (41.5%), which indicated that the university students surveyed had good opinion towards conserving plant biodiversity.

Table 7: Percentage of item on case statements (Agree-Disagree)

No	Item	Percentage
1	Exchange of plants between countries can increase plant diversity.	16,2
2	Consuming rice as a staple is an effort to maintain the presence of rice plants.	15,9
3	The herbal medicine industry is actually less profitable because it takes a long time to cure a disease and requires large area to grow herbs.	16,5
4	Rare plants are not a great concern as now we can learn about them through virtual learning.	17,6
5	Horticultural plants that do not sell on the market do not need to be preserved because they are unprofitable and cost a lot of money to grow.	16,9
6	The Green Open Space (RTH) has been reduced by the development of houses along riverbanks, which is also very important.	17,0
Total		100

Table 8: Percentage of category on conservation behavior of plant biodiversity (Agree-disagree)

Category	Total University Students	Percentage
Fair	83	41,5
Good	117	58,5
Total	200	100

In Table 1, the percentage of NS students in each statement was higher than SS students. This result was reasonable since NS students had been educated on plant biodiversity and the concept of conservation from senior high school. SS students mainly obtained these information from news and social media. In addition, NS students were more active in preserving the environment than SS students (Azrai *et al*., 2019; Ichsan & Rahmayanti, 2020) sustainable development, and saving resources. This is the underlying need to do this research. The purpose of this study is to describe students' pro-environmental behavior, in terms of groups of MIPA and non-MIPA students. Differences in perceived scientific background can be a distinguishing factor. The method used is descriptive method. Pro-environmental behavior data was taken from 130 students of Mathematics and Natural Sciences (MIPA).

Of all the instruments, it could be seen that there were some that had huge differences between NS and SS students. Those that had the biggest difference were No. 3 and 19, which were 40.8 % and 41.4 %, respectively. The result of item No. 4 suggested that NS students tended to be more active in reprimanding people over the destruction of plants compared to SS students. This could be due to several factors, including the students' desire to get public attention on conservation issues. This was different from the tendency of SS students to apply conservation behavior only at a personal level (Seechaliao, 2017; Uzun, 2012).

Another supporting factor was a higher sense of connection s with the environment in NS students, which gave them more desire to influence others to respect their surroundings. This was an important characteristic because university students were the key figures in promoting the environmental cause in their communities. This was relevant to statement

No.19, which described the zeal of NS students in joining activities to preserve plant biodiversity. In addition, SS students tended to be more comfortable in contributing to the preservation of the environment inn a personal capacity without trying to influence others (Djamahar *et al*., 2019; Kamerilova *et al*., 2016; Purwanto *et al*., 2020; Rahmayanti *et al*., 2020).

Other instruments with substantial difference in value points included statements No. 14, 15, 17 and 18. Their difference in percentage ranged from 37.2 % to 39.4 %. For statements No. 15 and 17, NS students tended to contribute more than SS students. This result presented contradictions with previous discussions, which stated that NS students had more awareness on environment than SS students. The fact, however, was that NS students often studied about environmental issues in their lessons, and this created a dilemma for them (Sigit *et al*., 2020). For example (according to statement No. 17), NS students might need to collect living plant specimens for their research, leading to the destruction of the plant. This was unavoidable since it was part of their education This action would teach NS students to be more appreciative towards their own environment, especially in terms of plant biodiversity (Ichsan *et al*., 2019)Junior High School (JHS. This could also explain why more NS students chose statements No. 18, which had a 39,.4 % compared with SS students.

In Table 2, it could be seen that the percentage of conservation behavior of plant biodiversity was higher among NS students. This might be influenced by the natural science knowledge possessed by NS students due to their close connection with their surrounding environmental condition. This could influence the students' sensitivity in conserving the environment, one of which was to preserve plants (Suryanda *et al*., 2020). In addition, NS students also had more understanding of conservation issues and were more aware about the impact of human existence on other life forms. Nevertheless, this did not mean that SS students were insensitive towards the environment, but it was just that their scope of their learning was more directed towards the humanities (Bela *et al*., 2016).

The differences in conservation behavior among NS and SS students were statistically significant in Table 3. This was related to a statement about NS and SS students who always had differences in their score regarding the environment, especially in promoting the environment on social media and joining an environmental organization (Bidegain *et al*., 2019).

The percentage of each dimension in Table 4 showed some differences. The "protection" dimension itself contained a form of effort to protect the diversity of plants that the students could find in their surrounding environment. In general, communities tended to be more capable in carrying out conservation efforts in the form of protection, because this effort was the easiest way. For example, when someone found a unique plant, the first response would be not to damage the plant. This effort prevailed among students, who tended to be more sensitive to the environment. They would maintain the presence of plants to support environmental sustainability (Supriyatin *et al*., 2019).The other dimensions were "preservation" (30.89%) and "utilization" (32.28%). The percentages of these dimensions were lower than "protection" because students were not actively involved in their activities.

The conservation behavior score among female students were higher than males most probably because females had a sense of caring more for the environment. For example, women might collect and care for plants that they found interesting in the outdoors. Another reason was because women were generally concerned about potential environmental risks than men (Aprile & Fiorillo, 2017; Braun *et al*., 2018; Runhaar *et al*., 2019).

This research also tried to identify the students' opinion on issues relating to plant biodiversity. The results in Table 6 indicated that students might have some misunderstanding on the concept of plant biodiversity. Item No. 1 (Exchange of plants between countries can increase plant diversity) seemed to be a good

point, but the students might not know that such action would lead to the introduction of invasive species that could be harmful to native plants. For item No. 2 (Consuming rice as a staple is an effort to maintain the presence of rice plants), more than half of the respondents chose the "agree" opinion. This might be because rice is a staple in Indonesia, and the respondents thought that this was a great way to preserve the existence of paddy *(Oryza sativa L.)* species. However, the existence of biodiversity was actually an important factor to support food production (Hooykaas *et al*., 2020). This means that cultivating and consuming one species of plant as a staple would not help in improving biodiversity; moreover, it would cause a "homogeneity" phenomenon that reduces the biodiversity of plants in a country. The respondents, however, on average, still got most of the concept correct as indicated by their "disagree" answer for the other items.

Table 7 shows that the students' understanding of plant biodiversity was good. The introduction of plant biodiversity to the public had brought good impact, because communities needed to know more about conservation (Ichsan *et al*., 2020). Students, as the younger generation with access to a wide range of information, tended to exhibit more critical thinking in learning biology and supporting environmental sustainability (Angelaina & Jimoyiannis, 2012; Orozco & Yangco, 2016).

Table 8 shows the percentages of conservation behavior of plant biodiversity values. The students seemed to have excellent ability to obtain information about plant biodiversity to improve their understanding of the subject (Camacho & Legare, 2015; Cukurova & Bennett, 2018; Kivunja, 2015). Therefore, the high self-awareness in terms of conservation behavior would also increase. The information they obtained would influence heir behavior. The process of critical thinking also influences the act of applying practice directly to daily life (Fitzpatrick & Schulz, 2015; Garcia, 2015).

Conclusion

The understanding of plant biodiversity among university students was good, thus the conservation behavior was also good. However, it turned out that there were differences between students who studied natural and social science. NS students had better biodiversity conservation behavior of plants than their social science peers. University students also had the same average result in the conservation indicator and the students, in general, had good responses to plant-biodiversity conservation behavior. Conservation behavior of plant biodiversity was important to maintain environmental sustainability. Activities on conservation behavior should be promoted in schools and universities to ensure environmental sustainability in the future generation. This study is limited by its range of students, which were sample in one city only (Jakarta) in the whole country. Therefore, future research involving more universities across Indonesia might be needed. This study showed that current environmental conservation programs in schools and universities are on the right track and should be expanded, especially for SS students.

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