

The green-based school and the creation of student's environmental attitude and behavior

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ARTICLE INFO	ABSTRACT
<p><i>Article history:</i> Received October 24, 2020 Received in revised form Nov. 01, 2020 Accepted Dec. 11, 2020 Available online August 01, 2021</p> <p><i>Keywords:</i> Adiwiyata school Built environment Environmental attitude Pro-environmental behavior</p> <p>*Corresponding author: Ova Candra Dewi Department of Architecture, Faculty of Engineering, Universitas Indonesia Email: ova.candewi@ui.ac.id ORCID: https://orcid.org/0000-0001-5418-3146</p>	<p><i>This study examines the relationship between the green-based school with students' environmental attitudes and behavior. Sustainable development has become the solution and commitment to save the earth from destruction due to human behavior. Environmental education plays an important role in creating an environmentally literate society. Adiwiyata School, an official form of environmental education, is one of the efforts to increase sustainable development through education as a way to improve student's environmental attitude and behavior. The research design used multiple case studies utilizing the observation method and questionnaire distribution to Adiwiyata and non-Adiwiyata schools. A New Ecological Paradigm (NEP) scale and a General Ecological Behavior (GEB) scale are used to measure student's environmental attitudes and behavior change. As a result, the green-based school creates influences in student's environmental attitudes (9.3%) and environmental behavior (12.3%).</i></p>

Introduction

Environmental problems occur due to a lack of human interaction, awareness, and understanding of the environment (BowoSantoso 2015; Meiboudi et al. 2018; Subroto 2019; Widodo 2019). Sustainable development has become a commitment and responsibility to save the earth (Pradono 2019). Organizations and governments create great efforts in several countries (Zhao, He, and Meng 2015), such as enacting agreements, laws, standards, and regulations to encourage people to accelerate the transition to sustainable development (Almeida et al. 2015). The Indonesian government and the international community have agreed on the importance of protecting the earth from pollution and damage. One of the government's commitments is to conduct this through the implementation of education, which is the key to preparing humans

with knowledge, understanding, expertise, values, and attitudes (Ministry of Environment 2012). Schools are the most effective media in disseminating environmental education and dealing with environmental problems at an early stage (Razak, Iksan, and Zakaria 2017). As a unique community, school is not only aimed at fulfilling cognitive needs but also providing education about the environment, skills, responsible behavior, and spreading the concept of environmental awareness to its students (Zhao, He, and Meng 2015). It is one of the best ways to shape environmental behavior by developing facilities that reduce the burden on the environment. Human efforts and behavior are very important to solve environmental problems (Kurisu 2015). Adiwiyata school is one of the public schools that implements an environmental education (EE) system in Indonesia. Adiwiyata school is a school that has received the Adiwiyata

award as a reward for its participation in an environmental conservation program and implementation of EE in schools (Ministry of Environment 2012). Children who grow up in the EE system will lead what they learn at their homes and surroundings, so they will contribute to a green environment later (Meiboudi et al. 2018). A person's behavior patterns change when they learn from their environment (Cummings 2012).

Green open spaces initiate awareness on human health (Dewi et al. 2018). It is important to find out architectural factors from green-based schools to comprehend environmental attitudes and behavior. School design plays an important role in inhibiting, encouraging, and facilitating behavior in school. Moreover, schools should be able to create green architectural designs since architecture is a pedagogical tool for environmental education. The physical elements in the school environment can provide cues to learn (Tucker and Izadpanahi 2017). A study on the relationship between school design and student achievement has been widely studied. Meanwhile, a study on the relationship between green school designs and students' environmental attitudes and behaviors is only slightly brought up. Therefore, a deeper understanding of the relationship between the built environment and environmental attitudes and behavior in students is required.

This study examines the relationship between the green-based school with a student's environmental attitudes and behavior. Additionally, it examines whether the greener features applied in the school have a greater impact on supporting the development of student's environmental attitudes and behavior. This study is expected to bring a revolution in school design and construction, especially in the school's-built environment based.

Method

According to (Izadpanahi 2015), environmental education aims to create individuals who behave environmentally friendly or to change individual behavior into positive behavior towards the environment. In achieving its goal there are three different approaches in environmental education: (1) through the school curriculum, (2) through the environmental initiatives, which focus on programs such as field trips or other outdoor

activities, (3) through the built environment. This approach uses architecture as a mediation to communicate environmental concepts to the school community in indoor and outdoor areas (Izadpanahi 2015). Environmental education through the built environment or architectural side will be discussed in this study.

The built environment provides space in shaping behavior (Asyera 2019). The built environment is a physical environment or space around the individual, where behavior can be formed. The individual's behavior relates to the surroundings and how the individual responds to what they see, touches, hears and smells (Griskevicius, Cantú, and van Vugt 2012). Green schools are built environments for school members that aim to instill environmental education and promote initiatives towards sustainable development. The criteria for green school based on environmental design include location, position and condition of the building, indoor air criterion, green space, material, water conservation, energy conservation, waste management, safety, security and health, eco-management, green education, transportation, and participation. These criteriums will be developed by authors and used as parameters of the green-based school assessment in this study as contained in table two.

This study used multiple case studies because based on theory, to explain an issue by presenting more pieces of evidence and facts can improve the understanding of the issue or a theory (Stake 2005; Creswell 2012). This study compares Adiwiyata schools of different rankings (city, province, national, and independent level), and also the non-Adiwiyata public schools as a comparison. A quantitative approach is used. The purpose, samples, research questions, and the entire study process are predetermined. The designs and green features applied in schools, as well as student's environmental attitudes and behaviors are all reviewed in this study. The research variables are quantified to produce data in the form of numbers used for analysis. The data is collected qualitatively through the observation method and questionnaires distribution to Adiwiyata and non-Adiwiyata schools.

Location and respondent

As in table 1, this study is conducted at five schools in Padang city with the following school criteria: (1) must be a public school in Padang city and registered as an educational institution

recognized by the Ministry of Education and Culture. Public schools are chosen as they have roughly the same design, so they can be compared, (2) Four selected public junior high schools, all of which bearing Adiwiyata of different ranks (city, province, national, and independent) at least in the last of approximately one year, (3) One public junior high school that is not registered as an Adiwiyata school. Every school is given the initials A, B, C, D, and E to safeguard the data privacy of the study object.

The respondents are male and female students of grades 8 and 9, aged 13-15 years, and registered as the school's student for at least one year. The process of behavior forming takes about 1-5 years (Prochaska and Velicer 1997). Total respondents are 240 students according to the calculation result using the G-Power software. Every school consists of 48 respondents with the same amount of gender and grades. This is based on the study that will calculate the significant value and average value of the measuring instrument used.

Table 1. Location and respondent of the study

School name	Predicate/level	Predicate year	Respondent
School A	Non-Adiwiyata	-	48
School B	Adiwiyata city	2017	48
School C	Adiwiyata province	2018	48
School D	Adiwiyata national	2018	48
School E	Adiwiyata independent	2010	48

Green-based school assessment tools

Table 2 shows one of the parameters in this study. These parameters are the result of several literature studies on sustainable school-built environments or the so-called green-based school in this study. Used as an assessment tool for the green-based school, A, B, C, D, and E related to the physical design and school facilities. There were 6 categories with 29 sub-categories to be assessed. The maximum and minimum points are 80 points and the 29 points respectively.

Table 2. Parameters of green- based school assessment

Parameters	Sub-parameters	Source
Outdoor		
Open space	Minimum $\geq 30\%$ of the total site area (including buildings)	[1] [2] [3] [4]
Grass	Minimum $\geq 25\%$ of the outdoor grass-planted	[4]

Parameters	Sub-parameters	Source
	area (excluding vegetation)	
Pedestrian	Easily accessible and using paving blocks	[3] [4]
Vegetation	Many native flowers, plants, and trees	[1] [3] [4]
Materials	Use eco-friendly and recycling materials	[1] [3] [4] [5]
Biomorphic patterns	Lots of natural patterns and shapes	[6]
Indoor (classroom)		
Vegetation	Many native flower and plants	[1] [3]
Furniture	Use eco-friendly and recycling furniture	[1] [3] [4] [5]
Materials	Use local, recycled, and environmentally friendly materials.	
Biomorphic patterns	Lots of materials and furniture with biomorphic patterns and shapes	[6]
Ventilation	Many windows and well-functioning.	[3] [5]
Green space access	Have direct access to the green space	[3] [4]
Electrical	Energy-efficient artificial light	[1] [3] [4] [5] [7]
Air conditioning	Not using AC (air conditioning) or fan	
Campaign posters	Have three categories of campaign posters (water/waste/energy)	[3] [5] [7]
Campaign poster shape and position	Each poster lies in its respective place, with a striking shape and color.	
Classroom orientation	Classroom openings lead to north or south and have trees to filter the wind and sunlight.	[1] [2] [3] [5]
Classroom position	Away from highways and parking lots	
Facilities of Green Education		
Have green education facilities in school (greenhouse, garden, fish pond, bio pore, hydroponics, etc.)		[8]
Waste management		
Bins	Have sorted bins in most classes with easy access.	[1] [2] [4] [5] [7]
Garbage dump	Have sorted garbage dump with easy access	
Poster/Sign	Have a sign in the bins and garbage dump	[3] [5] [7]
Composter	Have composter area	[5] [7]
Water management		
Water features	Use water-efficient toilets and faucet	[2] [3] [4] [5] [7]
Irrigation	Have a rainwater collection system that is easily accessible.	

Parameters	Sub-parameters	Source
Poster/Sign	Have a sign in the toilets & sink that is easily visible.	[3] [5] [7]
Plants	Have water conservation plants	[3] [4] [7]
Energy management		
Monitoring screen	Use energy monitoring screen that is easily accessible for the students	[3] [6] [9]
Poster/Sign	Have a sign-in electric	[3] [5] [7]
Notes: [1]: (Meiboudi et al. 2018); [2]: (Filippi and Sirombo 2015); [3]: (Krysiak, Young, and Fearn 2018); [4]: (NYC School Construction Authority & NYC Department of Education 2019); [5]: (Ramli et al. 2012); [6]: (Cummings 2012); [7]: (Goldman et al. 2018); [8]: (Ministry of Environment 2012); [9]: (Lockton, Harrison, and Stanton 2008).		

Environmental attitude and behavior assessment tools

New Ecological Paradigm scale and General Ecological Behavior scale adapted from the study (Tucker and Izadpanahi 2017; Yusup and Munandar 2015) were used in this study. The use of these two measuring instruments was motivated because this study examines schools, which is expected to affect the cognitive and behavior of students. The adaptation of these measuring instruments was carried out with experts. The reliability statistics of the NEP and GEB scale have met the standard (>0.05), with the Alpha Cronbach coefficient of 0.799 for NEP and 0.659 for GEB. Thus, each item in both measuring instruments is reliable in this study.

On this scale, the Author adds an image to each item to make it easier for students to understand the meaning of the question and to increase student attractiveness. A Likert scale that was reduced to a 4-point scale by removing neutral options is used to avoid centration (Djuwita and Benyamin 2019).

New Ecological Paradigm (NEP) scale

NEP scale is an assessment instrument to measure student's attitudes and views of the environment (Tucker and Izadpanahi 2017). It consists of 15 items and 3 dimensions, namely human intervention, Education for Sustainable Development (ESD) at school, and eco-rights as in table 3.

Table 3. NEP scale

Items	Dimensions
If humans continue to destroy nature, then we will shortly face a major environmental disaster.	Human intervention
One day humans will understand how nature works so they can control it.	
When humans destroy nature, there will be a bad impact.	
Humans are smart enough to not destroy the earth.	
Humans treat nature badly.	
I want to go to a school that cares about nature.	ESD at school
I believe that the light in the classroom should be produced by solar panels.	
I am willing to grow vegetables in the school garden.	
I feel closer to nature when classes are held in the outdoors.	
I feel better when I get natural light than artificial light while in the classroom.	
Humans must still obey the laws of nature.	Eco-rights
Nature will survive even with the bad habits of humans on earth. *	
Humans should rule all the whole nature well.	
Plants and animals have the same right to live as humans.	
Humans may destroy nature. *	

Source: adaptation of (Tucker and Izadpanahi 2017; Yusup and Munandar 2015)

General Ecological Behavior (GEB) scale

GEB scale is an assessment instrument to measure students's environmental behavior from simple things to behavior that requires great commitment and sacrifice (Tucker and Izadpanahi 2017). It consists of 11 items and 2 dimensions, namely pro-active eco-behaviors and resource and energy conservation as in table 4.

Table 4. GEB scale

Items	Dimensions
I participated in recycling activities at school.	Pro-active Eco-behaviors Resource
I help the teacher to take care of and clean the school garden.	
I read books about the environment (nature, trees, and animals).	
I pick up the trash left by my friends during recess and lunch.	
I use scrap paper with the back blank as scribbles for my math calculations.	
I separate organic and inorganic waste before disposal.	Resource and Energy Conservation
I didn't turn on the class lights because the light in my class was already bright.	
I forget to turn off the water after washing my hands in the school toilet.	
*	

Items	Dimensions
I bring too many supplies to school, so it should be thrown away. *	
I prefer to turn on the fan/air conditioning than opening a window when the room feels hot. *	
I forgot to turn off the light when I left the classroom. *	



Source: adaptation of (Tucker and Izadpanahi 2017; Yusup and Munandar 2015)


Result and discussion

Due to the Covid-19 pandemic, the green-based school assessment process was switched by taking image data by other parties who have expertise in the field of architecture according to predetermined parameters. Furthermore, measuring students' environmental attitudes and behavior with NEP and GEB scale is performed online through the google forms application.

School built environment analysis

Table 5. School built environment A, B, C, D, and E-assessment

School	Points
School A - non Adiwiyata	
	O :10 I :21 GE :1 Ws :7 Wt :5 E :2 Tot :46
Description: Open space area is 34.5% of the site; does not use energy-efficient lights; uses a fan; no water and energy conservation posters; no green education facilities area; has 11 sorted bins with stickers; no sorted garbage dump; no composter area; no rainwater system.	
School B - Adiwiyata city	
	O :12 I :22 GE :2 Ws :5 Wt :6 E :4 Tot :51
Description: Open space area is 43% of the site; have indoor plants and art corner in class; have a class garden; does not use energy-efficient lights; uses a fan; have water and energy conservation posters; have 7 green education area; does not use sorted bins and stickers; does not use sorted garbage dump; have a composter area.	

School	Points
School C- Adiwiyata province	
	O :12 I :23 GE :3 Ws :8 Wt :5 E :4 Tot :55

Description:
Open space area is 35% of the site; uses paving blocks; have indoor plants and art corner in class; have a class garden; does not use energy-efficient lights; uses a fan; have energy conservation posters; have 9 green education area; have 12 sorted bins; no sorted garbage dump; have a composter area.

School D - Adiwiyata national	
	O :12 I :24 GE :3 Ws :9 Wt :7 E :4 Tot :59

Description:
Open space area is 23% of the site; uses paving blocks; have indoor plants and art corner in class; have a class garden; does not use energy-efficient lights; uses a fan; have energy and water conservation posters; have 10 green education areas; have 7 sorted bins with stickers; have a garbage bank; have a composter area

School E - Adiwiyata independent	
	O :12 I :22 GE :2 Ws :5 Wt :6 E :4 Tot :55

Description:
Open space area is 28% of the site; uses paving blocks; uses a lot of recycled furniture; have murals on school walls; have indoor plants and art corner in the class, have a class garden; many wider windows; does not use energy-efficient lights; uses a fan; have water conservation poster; have 10 green education area; have 7 sorted bins; have garbage bank; have composter area.

Table 5 shows, school A, B, C, D, and E get 46, 51, 55, 59, and 54 points respectively. School D was declared the best school in implementing green features in its environment, especially in waste management and water conservation. In general, Adiwiyata schools (schools B, C, D, E) implement better green features than non-

Adiwiyata schools (school A), except for waste management actions.

Students' environmental attitude and behavior analysis

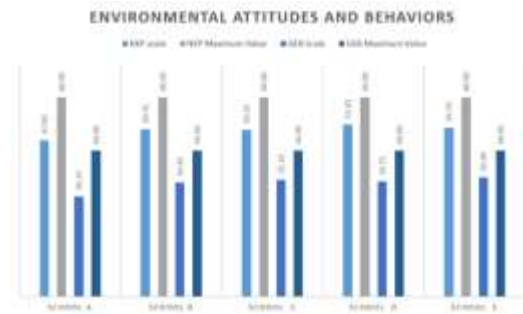


Figure 1. Student's environmental attitudes and behavior

The results of the NEP and GEB scale calculations in figure 1 found that student A obtained the lowest scores for environmental attitudes and behaviors among the other four schools, namely 47 points for the NEP scale and 30.19 points for the GEB scale. Student D had the highest environmental attitude points with a total of 51.81/60 points. Meanwhile, student E had the highest environmental behavior points with a total of 35.90/44 points. The highest average of environmental attitude and behavior achieved by student E with a total of 86.69 points, followed by students D, C, B, and A.

Adiwiyata schools have higher environmental attitude and behavior points than non-Adiwiyata schools. However, among the Adiwiyata schools (B, C, D, and E), schools with higher built environmental points did not always have high environmental attitude and behavior points as well. For example, school E, which get third-place for in-built environmental points, yet the student E had the highest average points for environmental attitude and behavior. School D gets the highest built environmental points, yet student D had a point average in the second rank or lower than school E students. This is due to the influence of the year implementation and the acquisition of Adiwiyata awards. For example, schools D and C that have a higher built environment than school E because they get the national and province-level Adiwiyata awards in 2018. Meanwhile, school E gets the independent Adiwiyata award in 2010. Thus, the built environment of D and C was still well controlled.

Meanwhile school E, as a school that first implemented environmental-based education, was deemed to be better prepared and accustomed to developing environmental attitudes and behaviors for its students, even though its built environmental points are not better than D and C.

Table 6. The significance of NEP points comparison between schools A, B, C, D, and E

NEP	A	B	C	D	E
A	-	Sig 0.121	Sig 0.106	Sig 0.304	Sig 0.046
		Not sig	Not sig	Sig.	Not sig
		R 1.5%	R 1.1%	R 9.2%	R 0.2%
B	-	-	Sig 0.124	Sig 0.097	Sig 0.065
			Not sig	Not sig	Not sig
			R 1.5%	R 0.9%	R 0.4%
C	-	-	-	Sig 0.106	Sig 0.032
				Not sig	Not sig
				R 1.1%	R 0.1%
D	-	-	-	-	Sig 0.160
					Not sig
					R 1.7%
E	-	-	-	-	-

*Notes:

Sig: significant level of pearson correlation (> 0.20);

R (R square): percentage relationship rate.

The test results of differences in significance value from IBM SPSS software in Table 6 showed that 90% of the NEP points among schools were not significant. Except for NEP points between school A and school D with a point difference of 4.81. A significant difference in environmental attitudes in this study occurred if it had a difference of points ≥ 4.81 . Students A, B, C, and E had the same level of environmental attitudes, while student D had a better environmental attitude than student A. The effect of the green-based school on student's environmental attitudes in this study was only 9.2% at maximum. This was due to the shaping of student's environmental attitudes that are more influenced by teaching factors as environmental attitudes are related to students' views or beliefs about the environment that can be taught by teachers and students' families (Tucker and Izadpanahi 2017).

Table 7. The significance of GEB points comparison between schools A, B, C, D, and E

GEB	A	B	C	D	E
A	-	Sig 0.260	Sig 0.226	Sig 0.261	Sig 0.276
		Sig.	Sig.	Sig.	Sig.
		R 6.7%	R 5.1%	R 6.7%	R 7.6%

GEB	A	B	C	D	E
B	-	-	Sig 0.306 Sig. R 9.4%	Sig 0.047 Not sig R 0.2%	Sig 0.388 Sig. R 15.1%
C	-	-	-	Sig 0.15 Not sig R 0%	Sig 0.230 Sig. R 5.3%
D	-	-	-	-	Sig 0.117 Not sig R 1.4%
E	-	-	-	-	-

*Notes:
Sig: significant level of pearson correlation (> 0.20);
R (R square): percentage relationship rate.

As in table 7, 70% of GEB points among schools are significant. A significant difference in environmental behavior in this study occurred if it had a difference of ≥ 4.25 . This means that students B, C, D, and E have better environmental behavior than student A. Adiwiyata's students (B, C, D, and E) have similar or insignificant environmental behaviors. The green-based school affects the student's environmental behavior by 5.1% - 15.1%. Green features in schools have an influence on students' behavior that can be seen from the green features applied to Adiwiyata schools (B, C, D, and E) more than school A. This was because sustainability practices can change the environmental behavior of the users (Cummings 2012).

Table 8. Correlation test result of green-based school with student's attitudes and environmental behaviors

	NEP scale significance value	GEB scale significance value
Green-based school	Sig. 0.000	Sig. 0.000
Degree of correlation level	Pearson correlation: 0.305 R square 9.3%	Pearson Correlation: 0.350 R square 12.3%
Relationship	Weak correlation, positive relationships	Weak correlation, positive relationships

*Notes:
Sig: significant level (< 0.05);
Pearson correlation: the degree of relationship;
R Square: percentage relationship rate.

Correlation test results from IBM SPSS software in all schools in table 8 found that there was a correlation between the green-based school

and students' environmental attitudes and behavior. Overall the formed correlation is a positive correlation, which means that the higher the green-based school, the higher the formed the attitudes and behavior of the students' environment. However, the degree of correlation formed was weak.

Analysis of student behavior in schools based on GEB scale results

The results of the GEB scale analysis related to the response of student behavior to the school space are shown in figure 2 till 4. Three elements have the highest relationship with students' environmental behavior based on the recapitulation in 5 schools: garden, classroom ventilation, and recycling area.

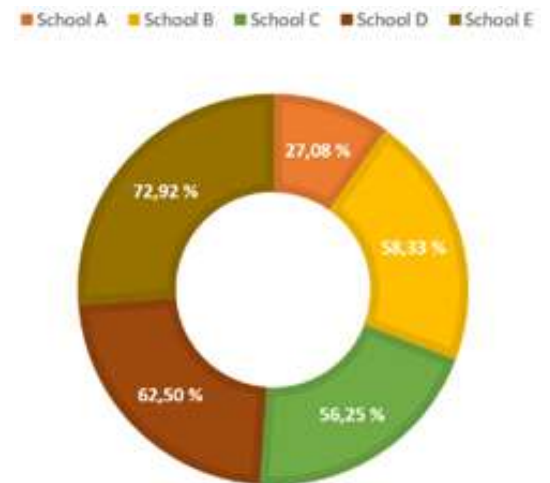


Figure 2. Percentage of student participation in recycling activities

Figure 2 shows that students B, C, D, and E (Adiwiyata school) did more recycling activities with a percentage of 58.33%, 56.25%, 62.50%, and 72.92% respectively. Student A only gained a percentage of 27.08%.

The availability of composter areas and art corners (recycled art space in class) at schools B, C, D, and E can encourage recycling activities in their schools. Additionally, the availability of waste banks at schools D and E increased student participation in recycling activities and also decreased the number of students who never participated in recycling activities.

From the results of the significance, the test showed that the recycling spaces affected student recycling behavior by 58.8%. The more availability of recycling space the higher the

recycling activity, and the more significant the recycling behavior is formed. Thus, to improve student recycling behavior, schools should provide lots of recycling space.

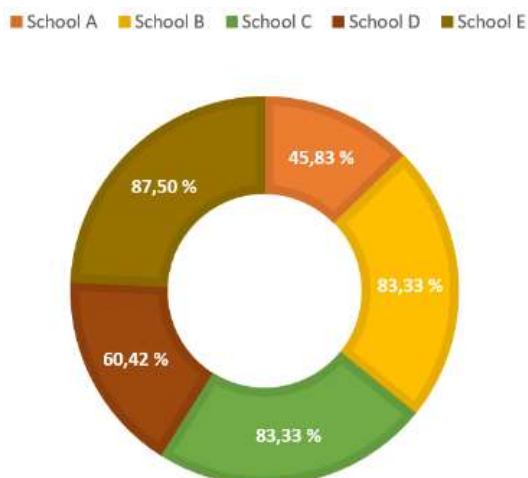


Figure 3. Percentage of students taking care of the school garden

Figure 3 shows that students B, C, D, and E (Adiwiyata school) took care and cleaned the school garden more often with a percentage of 83.33%, 83.33%, 60.42%, and 87.50% respectively. Student A only showed a percentage of 45.83%.

The availability of easily accessible gardens at schools A, B, C, D, and E can encourage students to take care of the garden and interact with vegetation. The availability of a class's garden increases the percentage of students caring for the garden (the percentages of schools B, C, D, and E are higher than school A). The availability of indoor plants in schools B and E also increased the student interaction, evidenced by 83.33% for student B and 87.50% for student E which are higher than student D except for student C with a percentage of 3.33%. The results of the significance test showed that the availability of green space affected student behavior in caring for plants by 13.5%.

According to this result, the greenspace has no major effect on behavior, because the formation of behavior was more influenced by teaching and instruction to take care of the school garden. This is shown by the Adiwiyata school program (B, C, D, and E) which often conducted class hygiene competitions (including the class garden). Thus, to increase the behavior of caring for plants, schools should provide more green space and as

close to students as possible, utilizing teaching and instruction on students.

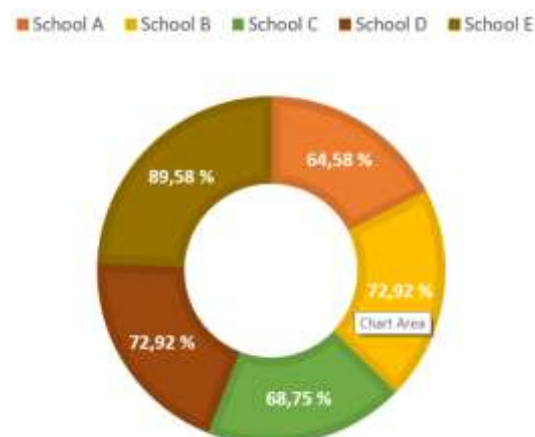


Figure 4. Percentage of students who do not turn on the lights

Figure 4 shows that students A, B, C, D, and E turned on the lights more often while studying in class with a percentage of 64.58%, 72.72%, 68.75%, 72.92%, and 89.58% respectively.

All schools have windows that extend in two sides of the classrooms with large openings and easy access to students. School E gets the highest percentage in carrying out this action because school E has the largest window area among the other schools. The results of the significance test showed that the width of the windows (openings) affected students' behavior to not turn on the lights by 13.3%.

According to this result, the width of the windows (openings) has no major effect on behavior because the light in the classroom was possibly sufficient. Consequently, the interaction of students in the form of turning on the lights is relatively small. Thus, to improve the behavior of energy conservation, the school should continue providing a large opening for lighting and encourage the students to be aware of the conservation through the teaching.

Conclusion

The green-based schools play important role in supporting the development of student's environmental attitudes and behaviors, but it's also influenced by how long the school has implemented environmental-based education (Adiwiyata program). The results of the statistical

analysis with IBM SPSS software showed that there was a positive relationship between the green-based school and student's environmental attitudes and behavior despite its weak correlation. The green-based school affects student's environmental attitudes by 9.3% and the environmental behavior of students by 12.3%. A greater relationship was found in the student's environmental behavior (GEB scale) in school compared to students' environmental attitudes.

This study found that the higher greener features applied to schools, the more impact will be made in supporting the development of students' environmental behavior. The presence of composter areas and waste banks in schools has increased student involvement in recycling. The more recycling space availability, the more significant recycling behavior was formed.

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Author(s) contribution

Restika R. Efiariza contributed to the research concepts preparation, methodologies, investigations, data analysis, visualization, articles drafting and revisions.

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