



## **EECN: Analysis, Potency, Benefit for Students Knowledge and Attitude to Conserve Mangroves and Coral Reefs**

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The purpose of this study was to measure student knowledge and attitudes in conservation of mangroves and coral reefs, introducing and applying Environmental Education Community Network (EECN) to students in wider scale. The method used in this research is a descriptive method and used a survey for gathering data. Samples were selected with simple random sampling in several schools and Jakarta State University. The results showed Average score of knowledge students from all levels were with low category. Average score of attitudes students from all levels were with high category. Students' knowledge was still low and attitudes in terms of mangroves and coral reefs were high. This result showed that students need a model that could enhance knowledge and attitude to conserve mangroves and coral reefs. EECN is one model that have the potential to empower students' knowledge and attitude in protecting the environment.

Keywords: attitude, EECN, knowledge, students, environmental education, conservation of mangroves

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## **INTRODUCTION**

The damages of mangrove and coral reefs have many negative impacts. One of them is the destruction of coastal and marine ecosystems. Many causes have caused such damage such as the occurrence of plastic pollution in the sea, the construction of various regions by cutting down mangrove forests and taking coral reefs for various human needs. This certainly has a bad impact on the environment. The community should begin to realize not to damage the marine and coastal environment (Cooper, Larson, Dayer, Stedman, & Decker, 2015; Sangroya & Nayak, 2017; Shabani, Ashoori, Taghinejad, & Beyrami, 2013; Strange, Jellesmark, Bladt, Wilson, & Rahbek, 2011).

People who can protect the marine and coastal environment are of course people who have extensive knowledge of mangroves and coral reefs. This knowledge is important because without extensive knowledge it will be difficult to implement mangrove and environmental conservation. Especially for students who live on the coastal area will be familiar with the environment. Students can play a role in supporting the sustainability of mangroves and coral reefs. One of the ways to instill knowledge is through educational institutions such as schools and universities. Schools and universities can be the right place to teach students various insights about mangroves. When students are given material about mangroves and coral reefs, students are expected to understand it and have an impact on their behavior in protecting the environment. In addition to knowledge, students also implanted various conservation values so as to shape their attitudes in terms of mangrove conservation and coral reefs (Ertz, Karakas, & Sarigöllü, 2016; Lemus, Seraphin, Coopersmith, & Correa, 2014; Okur-Berbeglu, 2015; Ozsoy, Memis, & Temur, 2009; Whitburn, Linklater, & Milfont, 2018).

Measuring the knowledge and attitudes of students in carrying out mangrove and coral reefs conservation is important to know the current conditions of student profiles. This kind of data collection is important as an evaluation material for teachers and schools in determining how much conservation material is given in learning at school. Based on the data obtained it is expected to be a kind of information for teachers and related parties. There are many ways that teachers can do in instilling a good attitude towards the environment and students' knowledge. One of them is through the Environmental education community network (EECN). This learning model emphasizes the many existing information networks. This learning model has been developed, then the validation and field trials have been carried out and have been declared valid to be used by students from various levels. This model is a learning model that has been successfully developed and has the advantage of being community-based (Sigit, Miarsyah, Komala, & Suryanda, 2017). This is important because 21st-century learning emphasizes the ability of students to collaborate and communicate (Aslan, 2015; Boholano, 2017; Fauzi & Fariantika, 2018; Heinrichs, 2016; Kuhlthau, 2010; Sharif & Cho, 2015; Syabilla, Suryanda, & Sigit, 2018). Through collaboration and communication, students can exchange information. EECN as a group learning model has the potential that is possible to be discussed and associated with the conditions of students' knowledge and attitudes.

Based on these problems, it is necessary to measure students' knowledge and attitudes. This is important because it is the basis for teachers in determining the composition of the material to be taught. In addition, the EECN model has the potential to empower students' knowledge and attitudes. The purpose of this study is to measure students' knowledge and attitudes to conserve mangroves and coral reefs and introduce EECN to students and university students. In addition, the EECN potential analysis is carried out as one of the learning models that can be used on students in all levels (Sigit et al., 2017).

## METHOD

This research was conducted in February-April 2019. The sample used was 294 samples from several schools and one university namely Jakarta State University. The schools and one university were in Jakarta, Bekasi, and Bogor city. These school considered to be a place of research because it has many students and is some of the favorite schools Jakarta, Bogor and Bekasi.

The method used in this research is a descriptive method. The data collection technique used is descriptive survey and analysis. The analysis carried out on the EECN learning model has been developed (Sigit et al., 2017). This EECN learning model has been conducted on a small scale trial, and shows an increase in students' knowledge and attitude scores (Sigit et al., 2018). As a model that has been successfully developed, the EECN website ([eecn.or.id](http://eecn.or.id)) is implemented and introduced to students with a wider scale. Implementation to students and the community in wider scale is done by dissemination through social media networks and through messaging applications, then they are invited to visit the EECN website. In addition, an analysis will be carried out in terms of its potential to be used on a broader scale and involve many parties including non-governmental organizations and so on. The analysis was preceded by measuring the students' knowledge and attitudes. Student knowledge instrument used 16 item test questions were valid and reliable. The maximum score that can be obtained by a student is equal to 16. The knowledge test instrument items are developed based on the basic competencies that exist at every level of education from middle school, high school to university. The slices of various basic competencies are summarized into several indicators. This is because knowledge about mangroves and coral reefs is general in nature, so instruments are made the same for various levels. The grid of knowledge test questions can be seen in table 1.

Table 1  
The Indicator of Student Knowledge Test Questions

No	Indicator	Item
1	Explain mangrove structure	1,2,3,4,5,6
2	Explain mangrove functions	7,8
3	Describe the classification and type of coral reefs	9,10,14
4	Explain the characteristics of coral reefs	11,12,13,15,16

Students' attitude instruments are used as many as 18 items and have been declared valid and reliable. This instrument was developed based on other research that has been done in Indonesia regarding mangroves (Sugandini, Rahatmawati, & Arundati, 2018). The

maximum score that can be obtained is 90. The grid of student attitude instruments can be seen in table 2 and the category of knowledge and attitude can be seen in table 3.

Table 2  
The Indicator of Instruments for Student Attitudes

No	Indicator	Item
1	Support extension services and seminars on mangroves	1,2,3,11,12
2	Encourage the role of the community in protecting mangroves	4,5,6,16
3	Stop using coral reefs as building and decorative materials	7,8,9,10,13
4	Support community participation in coral reef conservation	14, 15,17,18

Table 3  
The Category of Knowledge and Attitude

Category	Interval Score
Very High	$X > 81.28$
High	$70.64 > X < 81.28$
Moderate	$49.36 > X \leq 49.36$
Low	$38.72 > X \leq 49.36$
Very Low	$X \leq 38.72$

## FINDINGS AND DISCUSSION

Based on the results of measurements, the results of students' knowledge are obtained in maintaining mangroves and coral reefs. The results show that university's students obtain the highest average knowledge score. While, vocational students obtain the lowest value. Average score of knowledge students from all levels were 40.92 (scale 0-100) with low category. More details can be seen in table 4.

Table 4  
Student Knowledge Score of Coral Reefs and Mangroves

No	Item	junior high school (n=77)	senior high school (n=78)	vocational school (n=62)	university (n=77)
1	Explain the right statement to term the mangrove	0.43	0.50	0.48	0.48
2	Showing certain morphology of the mangrove	0.06	0.04	0.03	0.04
3	Showing parts of the mangrove with certain functions	0.84	0.79	0.81	0.97
4	Showing part of the breath root	0.26	0.24	0.34	0.45
5	Describe mangrove root types	0.42	0.40	0.52	0.52
6	Explain the concept of knee roots	0.53	0.60	0.45	0.38
7	Explain the role of mangroves	0.16	0.21	0.13	0.43
8	Explain how mangroves adapt to high salt levels	0.30	0.31	0.35	0.35
9	Mention the level of classification of coral reefs	0.27	0.29	0.23	0.60
10	Explain the causes of corals having different colors	0.44	0.56	0.47	0.31
11	Explain the cause of lagoon formation	0.06	0.18	0.18	0.18
12	Mention areas that are often encountered by coral reefs	0.40	0.60	0.48	0.77
13	Explain the origin of rocks	0.48	0.35	0.31	0.51
14	Mention the name of the largest Coral in the world	0.48	0.38	0.26	0.47
15	Mention the ideal temperature for coral reef life	0.19	0.21	0.16	0.10
16	Describe various threats to coral reefs	0.83	0.86	0.81	0.94
Average (0-16)		6.17	6.53	6.00	7.49
Average (0-100)		38.56	40.81	37.50	46.81

The second measurement is related to student attitudes in terms of maintaining mangroves and coral reefs. It is seen that the average attitude score of students at the university gets the highest score. Average score of attitudes students from all levels were 74.68 (scale 0-100) with high category. For more details, can be seen in table 5.

Table 5  
Score Attitudes of Students and University Students towards Coral Reefs and Mangroves

No	Item	junior high school (n=77)	senior high school (n=78)	vocational school (n=62)	university (n=77)
1	Following seminars on mangroves will increase knowledge about mangrove conservation	4.04	4.26	4.21	4.51
2	I do not like to take counseling about mangrove conservation because it is a boring thing	3.53	3.58	3.47	3.71
3	I am willing to supply information to the community about coral reef conservation.	3.47	3.64	3.60	3.91
4	The community must take part in fighting for the implementation of mangrove conservation	4.19	4.47	4.26	4.64
5	I like the people who carry out coral reef conservation activities.	4.26	4.44	4.34	4.68
6	I will take part in activities related to mangrove conservation	3.35	3.54	3.61	4.04
7	I like to collect home displays made from coral reefs.	2.90	3.31	2.77	3.74
8	Coral reefs can continue to be used as building materials even though the population is declining	3.51	4.00	3.69	4.45
9	Coral reefs are very beautiful if used as decoration	2.04	2.60	2.42	3.38
10	Destruction of coral reefs will not disturb the balance of the ecosystem.	3.88	4.28	4.00	4.60
11	I will not care about the latest issues about mangrove.	3.27	3.73	3.40	4.10
12	I like to see mangroves being used as tourist attractions.	2.18	2.08	2.08	2.47
13	If there is an opportunity, I will break the coral reefs in the sea to collect.	4.29	4.33	4.21	4.77
14	I am happy if the conservation center really strives for the conservation of mangroves and coral reefs.	4.14	4.51	4.42	4.74
15	Coral reefs will be abundant if there is development in the coastal area.	2.55	2.42	2.45	1.81
16	The destruction of mangrove areas on a large scale will have an impact on the imbalance of the coastal ecosystem.	3.95	4.36	4.11	4.62
17	I feel satisfied if something damages the coral reefs is punished legally.	3.79	4.05	4.05	4.26
18	I will report to the authorities if there are tourists who damage the coral reef.	4.09	4.10	4.27	3.96
Average (0-90)		63.43	67.71	65.37	72.38
Average score (0-100)		70.47	75.23	72.63	80.42

In addition to the students' knowledge and attitudes that have been measured, added data were also obtained relating to mangrove and coral reef conservation activities. There are two questions raised to the respondent which are related to extracurricular activities

taken at school and their interest in traveling. The question was asked to the respondent to know more deeply the characteristics of the respondents who filled out the instrument. This is needed to add data for further analysis. For more details, can be seen in table 6.

Table 6  
The condition of students

No	Item	Answer	junior high school (n=77)	senior high school (n=78)	vocational school (n=62)	university (n=77)
1	Are you taking part in a study / extracurricular group on science or the environment?	Yes	19	26	2	44
		No	58	52	60	33
2	Where do you prefer to travel?	Mountain	40	44	33	42
		Beach	37	34	29	35

Based on table 5, students at the university level participate in extracurricular activities in the field of natural science and the environment while the lowest percentage is in vocational school students. Then, for the interest in traveling students who go to the mountain are mostly obtained by senior high school students, while the lowest is by vocational school students. Besides going to the mountains, many students also like to travel to the beach. junior high school students have the most number with interest in traveling to the coast, while at least vocational school students.

Based on the results of measurements in table 4, 5 and refer from category in table 3, it can be concluded that students' knowledge in all level have low category. Then attitudes in maintaining mangroves and coral reefs are high, except junior high school students have moderate category. Low category of knowledge but a high category attitude showed that information obtained by students about coral reefs and mangroves is still needed. This makes it necessary to develop further various media and teaching materials related to mangroves and coral reefs. So that knowledge becomes higher and good attitudes will be better. In the knowledge aspect, some aspects are still low, for example, which relate to the characteristics of coral reefs. This is because students and undergraduate students do not get detailed explanations about environment from the teacher during learning, such as in Biology learning in schools (Ali & Arif, 2019; Derevenskaia, 2014; Havu-Nuutinen & Niikko, 2014; Hidayati, Pangestuti, & Prayitno, 2019; Kinay & Bagceci, 2016; Permana & Chamisijatin, 2019; Srisumra, Nontamolee, & Srijamon, 2014; Xia, 2017). Besides, on the aspect of student aspects that have a low score, one of them is that there are still many students who do not care about the habits of people who make coral reefs as ornaments or building materials. This is because there are still many students who do not understand the danger of making coral reefs as ornaments. Students should have a good attitude in the context of protecting the environment.

All problems of students' knowledge and attitudes can be solved by using one of the learning models namely Environmental Education Community Network (EECN). This learning model is very relevant for use by teachers in empowering students' knowledge and attitudes. This EECN learning model has been conducted on a small-scale trial, and

shows an increase in students' knowledge and attitude scores (Sigit et al., 2018). EECN model has been introduced and applied to students. The following are some of the characteristics offered by the EECN model can be seen in table 7. Then EECN learning model syntax and activities can be seen in table 8.

Table 7

EECN Characteristics

No	Indicator	Characteristics
1	Complete learning media	Complete learning media, consisting of textbook websites and worksheets
2	Location of learning	It can be done outside the classroom and allows it to be carried out in certain areas such as the ecotourism area
3	Execution time	Can be done outside the hours of learning in school, more flexible and not bound to the time of learning in class
4	Students involved	This model allows various levels of students to take part in both elementary, middle and high school to university students
5	Responses from students after learning from EECN	Facilitate environmental learning both in the classroom or outside the classroom, while also helping students understand things about mangroves and coral reefs

Source: (Sigit et al., 2017)

Table 8

EECN Learning Model Syntax and Activities

No	EECN Syntax	Activities to conserve coral reef and mangrove
1	Teacher (Instructor / Lecture) divides students into several groups	The teacher divides students into several groups
2	Students and their groups discuss the environmental problems that will be solved	Students in this case agreed to solve the problems of coral reefs and mangroves
3	Students do plan learning activities, to solve these environmental problems (activities can be indoor or outdoor)	Planning activities on the thousand islands
4	The teacher coordinates with students and various relevant parties about the plan of learning activities	The teacher coordinates with students and community leaders in the thousand islands to carry out mangrove and coral reef conservation activities
5	The teacher gives instructions and participates in the implementation of learning activities	The teacher gives brief material about mangroves and coral reefs, and participate
6	Students observe and write the report results of observations, and conduct analysis during the learning activities. Students are also creating products to learning activities being carried out	Students carry out mangrove and coral reef planting activities and record the results of activities on a piece of paper and record the results of the analysis. The product created is a record of activities (a kind of research paper)
7	Students present their work in front of their friends in groups about the observations of the learning activities and other groups give questions or comments to the groups that present	Students made presentations and other groups asked about mangroves and coral reefs and commented on the EECN coral reefs and mangrove website
8	The teacher evaluates these learning activities	The teacher gave a test about mangroves and coral reefs
9	Students give comments and conclude the main points of learning activities that have been carried out (can be directly or through the website or social media)	Student representatives were asked to conclude the activity and comment on the EECN website

*Note:* EECN learning model can be used in other environmental problems such as waste recycling, green consumerism, eco-label, climate change etc. Not only limited to mangrove and coral reef problems. EECN can also be used at all levels of education from elementary school, junior and senior high school and university

Based on the advantages possessed, EECN has broader potential to improve students' knowledge and attitudes in environmental learning. EECN has good potential to be used on a broader scale and a greater number of people and involves many parties such as non-governmental organizations, government, informal education institutions and so on. This is because environmental learning must be carried out contextually and students are invited to go directly to the field (Gündüz, Alemdağ, Yaşar, & Erdem, 2016; Kartikaningtyas, Kusmayadi, & Riyadi, 2018; Koutsoukos, Fragoulis, & Valkanos, 2015). Based on the data from the measurement of knowledge in table 1, students cannot perfectly answer many questions. This is because their insights are less about mangroves and fewer reefs. This narrow insight can be improved by learning that is more active and in accordance with what students want (Camacho & Legare, 2015; Juhanda & Maryanto, 2018; Supriyatin, Nurnawati, & Heryanti, 2016; Uzun, 2012).

In this study, the measurement results of students' knowledge still low and attitudes that are high showed that the use of EECN is still not maximal and needs to be stressed again. Learning using EECN has characteristics that are very suitable for use by teachers who want to improve their students' knowledge, in this case regarding the conservation of mangroves and coral reefs. Students can interact with other students from various backgrounds and are taught to work together. This has an impact in addition to increase knowledge as well as having an impact on the ability of other students such as the ability to collaborate and communicate that is very much needed in 21st-century learning (Quieng, Lim, & Lucas, 2015; Sharif & Cho, 2015). EECN in its learning emphasizes collaboration aspects in the community because that is the superiority of EECN itself. Students who are able to collaborate are expected to have a conservative attitude towards the environment (Haddow, Xia, & Willson, 2017; Karsten et al., 2015; Nissim, Weissblueth, Scott-Webber, & Amar, 2016; Sandberg & Ohman, 2011).

The attitude of students based on the measurement results in table 2 shows that between levels of education are not too different in their attitude scores. Even so, they can access various information about mangroves and coral reefs on the internet (Brown, 2017; Jiang et al., 2017; Lee, 2014; Nugraini, Choo, Hin, & Hoon, 2013; Reyna, Hanham, & Meier, 2018; Suhendar & Wahyuni, 2018; Wolfson & Funke, 2014; Yusop & Sumari, 2013). The amount of information obtained from the internet can change one's knowledge and attitudes in maintaining marine ecosystems.

EECN has a role in providing information through various media that have been developed, such as websites. Through the website, learning that uses this EECN model can take place at any time without time constraints. Students can access the information anywhere and anytime they want. This certainly facilitates the teacher in teaching (Fatih, 2016; Fitriani, Adisyahputra, & Komala, 2018; Nugraini et al., 2013; Ramdhani & Muhammadiyah, 2015). From this reason, it can be said that the EECN model has great potential in environmental learning.

EECN is a product development model but has only been used on a small scale. So more massive use is needed, for example, applied in learning at school at every level. In a wider range of uses, EECN can be used in more general activities but also in class learning. For example, preservation activities carried out by certain institutions, can use various media that have been developed in EECN. Various components can also access this information openly and the information provided is easy to understand. This will have an impact on broad information to the community and make the community care about the environment (Choudri et al., 2017; Istiana & Awaludin, 2018; Ito & Kawazoe, 2015; Norman, Nordin, Din, & Ally, 2016; Nurwidodo, Hendayana, Hindun, & Sarimanah, 2018; Paço & Rodrigues, 2016; Siphai, 2015; Yedla & Park, 2017).

### CONCLUSION

Based on the results of the study, students' knowledge is still low category from all levels. Students attitude have high category, except in junior high school have moderate category. It can be concluded that the score of students' knowledge and attitudes in maintaining mangroves and coral reefs is still needs to be improved. The results of the introduction and application of EECN to students show that EECN has advantages that can be used to improve students' knowledge and attitudes. The use of EECN must be emphasized again to become more frequent and intensive at least at the end of each semester. In a broader use, EECN can be used in community activities so that people get a broader insight into mangroves.

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