

Raising Environmental Awareness in School: A Case Study of Environmental Education Through Implementation Adiwiyata-based Curriculum

Riezky Maya Probosari^{1, a) (*)}, Febriani Sarwendah Asri Nugraheni^{2, a)} and Fatma Widyastuti^{3, b)}

^{1,2}*Sebelas Maret University, Surakarta, Indonesia*

³*Balai Diklat Keagamaan Semarang, Semarang, Indonesia*

^{a)}*Corresponding author: riezkymaya@fkip.uns.ac.id*

^{a)}*febrianisarwendahasri@staff.uns.ac.id*

^{b)}*fatmawidyastuti.wi@gmail.com*

Abstract. The Adiwiyata school project is a program of the Indonesian Ministry of the Environment which aims to make school members responsible for protecting and managing the environment by way of good school governance to encourage sustainable development. This research was conducted to determine the understanding and environmental awareness of the secondary school community in Central Java, Indonesia, held in one junior high school and one senior high school in Semarang Regency that is applying to become Adiwiyata schools at the national level. The participants were 49 teachers and 60 students from the two schools, had been tested their environmental knowledge through questionnaires regarding the implementation of the Adiwiyata-based curriculum and its impact on environmental attitudes and scientific attitudes of students. Structured interviews were also conducted to dig deeper into the problems and solutions made by teachers related to the Adiwiyata project. The results showed that most teachers had tried to incorporate environmental elements into their learning tools, both in the form of assessment instruments and the media. Meanwhile, it was found that the level of environmental awareness of students was classified as high, especially among female students. Follow-up research that refers to optimizing environmental awareness through learning strategies and media is immediately carried out.

Keywords: Adiwiyata, environmental awareness, environmental education.

INTRODUCTION

The rapid development in all fields has a positive impact on the level of human welfare, but on the other hand, it also has an anthropogenic impact on the environment. The term anthropogenic refers explicitly to the effects caused by human activities both directly and indirectly, which include changes in the biophysical environment and biodiversity-ecosystem and natural resources (Lashchinskiy, Zolnikov, Glushkova, & Lashchinskaya, 2016). The activities of exploiting and modifying the environment to suit human needs have a severe impact, especially when human populations and interests are always developing and growing.

The understanding that maintaining the stability of human relations and the environment is challenging, especially the consequences of unauthorized use of natural resources and exponential population growth is a disaster, has opened up global human awareness to change the way of viewing, attitudes and to handle the wise use of the environment (Edwards, 2016). In Indonesia, efforts to maintain and supervise the environment are stated in



Law No. 32 of 2009 concerning Environmental Protection and Management (Kementerian Lingkungan Hidup Indonesia, 2009). Article 1 paragraph 2 states that environmental protection and management is a systematic and integrated effort carried out to preserve environmental functions and prevent environmental pollution and damage, which includes planning, utilization, control, maintenance, supervision, and law enforcement. Regulations and written rules from the government have been rolled out. However, community awareness in protecting the environment is still relatively low, as evidenced by a large number of environmental cases occurring in the community. So the character of environmental awareness must begin to be initiated and habituated from an early age, both in the family environment (non-formal channels) and in the scope of formal education through the application of integrated environmental education in learning at all levels of the school.

In Indonesia, environmental education began to be integrated into the realm of formal schooling by the Directorate General of Primary and Secondary Education of the Ministry of National Education in 1984. The 1984 curriculum has included population and environmental material in all subjects in international and vocational schools. Subsequently, in 1989/1990, the Population and Environmental Education program was implemented, which began in 2003, followed by the development of an Environmental Cultured School. Collaboration between the Ministry of Environment and the Ministry of National Education started to collaborate in 1996 but reappraised in 2005 and 2010. The results of this cooperation were realized through the development program for Environmental Education at the level of primary and secondary education through the Adiwiyata program. Adiwiyata's definition comes from the word "adi," which means good, beautiful, or perfect, and the word "wiyata," which means the place where people get knowledge, norms, and ethics. Furthermore, Adiwiyata is an excellent place to get the experience, rules, and ethics needed to obtain welfare. The Adiwiyata program aims to bring accountable school members for environmental assistance and management through good school governance to support sustainable development (Kementerian Lingkungan Hidup Indonesia, 2013; KLH & Kemendikbud, 2017b, 2017a).

The Adiwiyata Program is the actualization of the youth development who care about the environment, support nature rehabilitation, and preserve the environment. The younger generation must have an attitude of character and environmental awareness, and the Adiwiyata-based school is an ideal place to implement it. Adiwiyata school curriculum is a real practice of Law no. 32 of 2009 concerning Environmental Protection and Management (Kementerian Lingkungan Hidup Indonesia, 2009) and Minister of the Environment Regulation No. 05 of 2013 concerning Guidelines for Implementation of the Adiwiyata Program (KLH & Kemendikbud, 2017a). Based on its level, there are several types of Adiwiyata schools, namely district/city Adiwiyata schools, rural Adiwiyata schools, national Adiwiyata schools, and the highest is Adiwiyata Mandiri schools. Preliminary observations and interviews with the two partner schools showed that they felt very enthusiastic and motivated to become Adiwiyata schools. Some obstacles faced by the school are: 1) lack of knowledge on how to formulate policy schools with environmental insights, 2) limited knowledge about the formulation and implementation of an environment-based curriculum, 3) how to manage participatory-based ecological activities, and 4) how to manage environmentally friendly infrastructure.

In addition to an interest in science, using a scientific approach to inquiry, environmental awareness is also a component of the scientific attitude that has existed in the PISA framework since 2015 (Cresswell, Schwantner, & Waters, 2015; OECD, 2018b). Context, competence, attitude, and knowledge are interrelated series. Context (whether personal, local, or global) requires the ability of individuals to explain scientific phenomena, evaluate and design scientific investigations, and interpret data and evidence scientifically (OECD, 2018a; PISA, 2006). Scientific attitudes influence all these processes, for example, interest in science, assessing scientific approaches to inquiry, and environmental awareness. This fact also occurs in the process of gaining knowledge, which includes knowledge of content, procedural, and epistemic sources. So environmental awareness is an indispensable attitude to support environmental preservation. Law Number 23 of 1997 (Kementerian Lingkungan Hidup Indonesia, 1997) concerning Environmental Management article 5 paragraph (3) states that "Every person has the right to play a role in environmental management." Human activities are included in contributing to the destruction of nature, so that environmental awareness must be instilled in everyone from the beginning, especially in the community and school environment. Environmental awareness is an attitude about the ecological consequences of human behavior and the tendency to react to environmental problems. In practice, environmental awareness is also often referred to as caring for the environment or the environment and affiliated with environmental responsibilities and behavior (Ham, Mrcela, & Horvat, 2016).

Scientific problems that occur in the real world, including environmental sustainability issues such as smoke pollution on the island of Sumatra due to forest fires, increasing the volume of waste that is not offset by recycling, or its use is part of the real world of education. This research highlights the environmental problems faced in the school environment, which include handling school waste, utilizing environment-friendly infrastructure, and



building healthy living habits and environmental awareness. Several studies have highlighted the importance of planning and administrative steps taken to deal with environmental issues wisely and effectively, and most of it leads to the same view, namely that the role of public education is crucial in instilling environmental awareness (Coertjens et al., 2010; Mogome-Ntsatsi & Adeola, 1995; Nagra, 2010; Singh, 2013).

The successful implementation of environmental education in Adiwiyata schools requires careful preparation and planning, especially in preparing the mindset and motivation of the entire school community. Teacher and student interaction is an essential key in implementing the Adiwiyata program in schools. Data regarding the initial description of students' environmental awareness must be traced as a reference for determining the program to be carried out. Schools must also know teacher competencies in managing environment-based learning. This research was conducted to determine the understanding and environmental awareness of the secondary school community in Central Java, Indonesia, and how the readiness of teachers for the implementation of environment-based learning through the Adiwiyata program in schools.

METHOD

This quantitative research (Creswell, 2014) was conducted through a survey method. The total participants in this study were 49 teachers and 60 students from two high schools in Central Java, Indonesia. The sample was taken from two public high schools with the following details :

Table 1. Participants Distribution

1. Secondary School Level		3. Teachers Distribution		4. Students' Distribution												5.
2.		6.	7.	8. Grade 7	9. Grade 8	10. Grade 9	11. Grade 10	12. Grade 11	13. Grade 12	14. Total						
		15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.		
28. Junior		29.	30. 3	31. 5	32.	33.	34.	35.	36.	37. -	38.	39.	40.	41.	42.	43. 1
44. Senior		45. 2	46. 6	47.	48.	49.	50.	51.	52.	53.	54.	55.	56.	57.	58.	59. 8
60. Total		61. 0	62. 9	63.	64.	65.	66.	67.	68.	69.	70.	71.	72.	73.	74.	75. 09

The age of the teacher ranges from 28 to 55 years, while students range from 12 to 15 years for junior high school and 14 to 18 years for senior high school. Each student fills in a questionnaire about an environmental knowledge questionnaire that refers to environmental awareness, while the teachers work on a survey about their responses and readiness in the Adiwiyata program. In detail, the questionnaire items include the following components:

Table 2. Questionnaire List

76. Code		77. For Students	78. For Teachers
		79. Topic to Evaluate Environmental Awareness	80. Item to check teachers' preparation and readiness in Adiwiyata-based curriculum
81. Q1		82. Ozone depletion	83. Understanding the vision and mission of the environment-based school.



84.	Q2	85.	Pollutant	86.	An environment-based learning plan.
87.	Q3	88.	Air pollution	89.	Utilizing the environment as learning tools
90.	Q4	91.	Soil pollution	92.	Linking material with the natural phenomenon.
93.	Q5	94.	Water pollution	95.	Discussing environmental problems that occur significantly.
96.	Q6	97.	Acid rain	98.	Assessing students' attitudes related to the environment.
99.	Q7	100.	Renewable energy	101.	Actively involved in handling school waste.
102.	Q8	103.	Waste reduce	104.	Stimulating students to apply HOTS related to the environment.
105.	Q9	106.	Waste re-use	107.	Cultivating a healthy life.
108.	Q10	109.	Waste recycle	110.	Getting used to the school environment that always clean.
111.	Q11	112.	Waste replace	113.	
114.	Q12	115.	Waste refill	116.	
117.	Q13	118.	Waste repair	119.	

All of the questionnaires is assessed for each item, using a Likert 3-scale as follows: “good” (3), “fair” (2), and “poor”(1). Structured interviews were conducted to strengthen the opinions and responses of teachers and students in the school environment. Preparation and data collection was carried out for six weeks, in August-September 2019. The data were analyzed using the Rasch Model(Cavanagh & Waugh, 2011) carry out with Winstep.

RESULT AND DISCUSSION

Environmental education needs to be initiated early on in various circles. School, as a public space, which is a gathering place for many people, positively contributes a lot of rubbish, especially from student activities. The habit of littering, waste of water, and lack of maintenance of the environment in schools are issues of concern. The school community should build positive habits, guides the student about the importance of loving and caring for the environment. Actual actions that must be accustomed, such as: disposing of trash in its place according to its groups as organic and inorganic waste, energy-saving culture. Response to make the school environment to be clean and healthy must be instilled so that they are literate in environmental issues and begin to take simple actions in their environment or around it. Results of data analysis regarding students' environmental awareness are presented in the statistical summary. The summary statistics show overall information about the quality of student response patterns, the quality of the instruments used, and the interaction between people and items (Reckase, 2009).



SUMMARY OF 59 MEASURED (NON-EXTREME) Person

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	31.5	13.0	2.13	.70	.98	.0	1.07	.2
S.D.	5.8	.1	2.22	.16	.36	.9	1.37	.9
MAX.	38.0	13.0	5.19	1.09	2.04	2.2	9.90	4.2
MIN.	17.0	12.0	-3.16	.57	.46	-1.9	.27	-1.0
REAL RMSE	.76	TRUE SD	2.09	SEPARATION	2.76	Person	RELIABILITY	.88
MODEL RMSE	.72	TRUE SD	2.10	SEPARATION	2.93	Person	RELIABILITY	.90
S.E. OF Person MEAN = .29								

MAXIMUM EXTREME SCORE: 1 Person

SUMMARY OF 60 MEASURED (EXTREME AND NON-EXTREME) Person

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	31.6	13.0	2.20	.72				
S.D.	5.8	.1	2.27	.22				
MAX.	39.0	13.0	6.53	1.87				
MIN.	17.0	12.0	-3.16	.57	.46	-1.9	.27	-1.0
REAL RMSE	.79	TRUE SD	2.13	SEPARATION	2.71	Person	RELIABILITY	.88
MODEL RMSE	.75	TRUE SD	2.15	SEPARATION	2.86	Person	RELIABILITY	.89
S.E. OF Person MEAN = .30								

Person RAW SCORE-TO-MEASURE CORRELATION = .99
 CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .92

SUMMARY OF 13 MEASURED (NON-EXTREME) Item

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	145.8	59.9	.00	.32	.99	-.1	1.16	.0
S.D.	14.4	.3	1.46	.06	.25	1.3	.95	1.4
MAX.	173.0	60.0	2.16	.50	1.50	2.8	4.28	3.6
MIN.	119.0	59.0	-3.53	.27	.60	-2.3	.41	-2.3
REAL RMSE	.34	TRUE SD	1.42	SEPARATION	4.16	Item	RELIABILITY	.95
MODEL RMSE	.33	TRUE SD	1.42	SEPARATION	4.37	Item	RELIABILITY	.95
S.E. OF Item MEAN = .42								

Figure 1. Screen capture of a summary statistic for students' environmental awareness

The result of the Person Measure is 2.13, indicating that the tendency of students' abilities is higher than their level of difficulty. Cronbach's Alpha, which measures reliability or interaction of people with items, shows 0.92 so that the reliability is categorized very well. Person reliability was 0.88, and item reliability was 0.95, indicating that the consistency of student answers at all grade and gender is good, and the quality of the items used was very good. The highest quality environmental awareness positions are displayed as follows:

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	EXACT MATCH EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Person
49	39	13	6.53	1.87	MAXIMUM MEASURE			.00	.00	100.0	100.0	49FE	
42	38	13	5.19	1.09	.74	-.1	.27	-.3	.43	.25	92.3	92.3	42ME
43	38	13	5.19	1.09	.81	.0	.31	-.2	.40	.25	92.3	92.3	43ME
47	38	13	5.19	1.09	.81	.0	.31	-.2	.40	.25	92.3	92.3	47FE
51	38	13	5.19	1.09	1.09	.4	.64	.2	.23	.25	92.3	92.3	51MF
53	38	13	5.19	1.09	1.09	.4	.64	.2	.23	.25	92.3	92.3	53MF
58	38	13	5.19	1.09	1.09	.4	.64	.2	.23	.25	92.3	92.3	58FF
59	38	13	5.19	1.09	1.09	.4	.64	.2	.23	.25	92.3	92.3	59FF
38	37	13	4.31	.83	1.23	.6	.84	.4	.25	.34	84.6	84.7	38FD
48	37	13	4.31	.83	.77	-.3	.43	.0	.49	.34	84.6	84.7	48FE

Figure 2. Screen capture of students' rank with the best environmental awareness

It turned out that the highest environmental awareness ranking was dominated by 11th level students (4th most top position), followed by 12th-grade students (4-8 position), 10th-grade students (9th position), and 12th level students (10th position), most of them are female. Some of the students on the list are known as creative students that engaged in craft production, especially in utilizing school waste in various forms. The rest of them are active in extra-curricular scouting and youth scientific work. Students' ten lowest positions of environmental awareness are shown below :



ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	TOTAL MEASURE	MODEL		INFIT		OUTFIT		PT-MEASURE		EXACT MATCH		Person
				S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%		
11	24	13	-.66	.58	.71	-.7	.68	-.8	.65	.59	76.9	70.5	11MB	
12	24	13	-.66	.58	.83	-.3	.84	-.3	.57	.59	76.9	70.5	12MB	
14	24	13	-.66	.58	1.27	.8	1.25	.7	.79	.59	61.5	70.5	14MB	
1	22	13	-1.32	.57	.82	-.4	.77	-.6	.71	.58	69.2	66.7	01MA	
8	22	13	-1.32	.57	1.19	.7	1.23	.7	.50	.58	53.8	66.7	08FA	
10	22	13	-1.32	.57	.98	.1	.95	.0	.62	.58	69.2	66.7	10FA	
2	21	13	-1.65	.58	1.26	.9	1.41	1.1	.19	.58	46.2	66.3	02MA	
7	20	13	-1.99	.59	.77	-.7	.69	-.8	.80	.57	76.9	68.2	07FA	
3	19	13	-2.34	.61	.82	-.5	.73	-.5	.58	.57	69.2	69.5	03MA	
5	17	13	-3.16	.69	1.39	1.0	1.66	1.0	.25	.55	69.2	78.1	05MA	

Figure 3. Screen capture of students' rank with the lowest environmental awareness

Whereas the ten lowest environmental awareness rankings were 7th and 8th-grade students, dominated by males. Almost all of the students with weak environmental awareness come from junior high school. Further interviews showed that they were indeed not accustomed to accessing news about the environment so that many terms or environmental problems were unknown to them. The environmental awareness questionnaire contains several environmental issues that occur in the real world. The observations showed that some students did not understand all the issues raised. The table below shows the order of environmental problems from those considered the most difficult to easy by students.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	TOTAL MEASURE	MODEL		INFIT		OUTFIT		PT-MEASURE		EXACT MATCH		Item
				S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%		
11	119	59	2.16	.28	1.00	.0	1.00	.1	.74	.74	65.5	69.4	Q11	
13	123	60	2.02	.27	1.00	.1	.99	.0	.73	.74	72.9	69.0	Q13	
8	134	60	1.18	.28	1.50	2.8	1.81	3.6	.38	.74	52.5	68.6	Q8	
1	141	60	.63	.29	1.02	.2	.91	-.4	.78	.74	72.9	71.8	Q1	
7	142	60	.54	.29	1.09	.6	1.02	.1	.76	.74	72.9	72.3	Q7	
10	142	60	.54	.29	.65	-2.3	.56	-2.3	.81	.74	78.0	72.3	Q10	
6	145	60	.29	.30	.97	-.1	.87	-.4	.79	.74	79.7	74.0	Q6	
9	152	60	-.37	.32	1.22	1.1	1.07	.3	.63	.73	69.5	78.2	Q9	
12	152	60	-.37	.32	.94	-.2	.71	-.8	.81	.73	79.7	78.2	Q12	
3	155	60	-.69	.33	.91	-.3	.78	-.4	.77	.72	84.7	80.1	Q3	
5	155	60	-.69	.33	.60	-2.0	.41	-1.8	.85	.72	88.1	80.1	Q5	
4	163	60	-1.70	.38	.64	-1.5	.76	-.2	.76	.68	91.5	84.7	Q4	
2	173	60	-3.53	.50	1.26	.9	4.28	1.9	.37	.52	91.5	90.6	Q2	
MEAN	145.8	59.9	.00	.32	.99	-.1	1.16	.0			76.9	76.1		
S.D.	14.4	.3	1.46	.06	.25	1.3	.95	1.4			10.6	6.4		

Figure 4. Screen capture of environmental awareness concepts that are considered difficult for students

The most difficult concepts in students' opinions are Q11 (waste replacement), Q13 (waste improvement), Q8 (waste reduction), Q1 (ozone depletion), Q7 (renewable energy), Q10 (waste recycling), Q6 (acid rain), Q9 (reuse of waste), Q12 (refill waste), Q3 (water pollution), Q5 (water pollution), Q4 (soil pollution), and Q2 (pollution). This fact shows that coaching students regarding the 6 R's of Zero Waste (reduce, reuse, recycle, respect, replenish, and refuse) needs to be intensified. Practically, this can be started from the habit of students buying food in the school canteen. Efforts to minimize plastic waste can be made by habituating students to bring food containers and drink bottles from home so that the food and drinks provided by the canteen are not packaged in plastic. Other environmental problems not yet known to students such as ozone, renewable energy, and so on can be anticipated by habituating students to always be literate with environmental news, both from television or online news.

As the facilitator, teachers play a critical role in shaping the character of students' environmental awareness. In connection with the Adiwiyata program, teachers must have the readiness to develop students' mental and attitude to play an active role in environmental education. Teacher preparation must be prepared since the planning of teaching, mastery of knowledge, and habituation to be more sensitive to the environment. Teacher readiness in implementing Adiwiyata-based curriculum learning is shown as follows:



SUMMARY OF 48 MEASURED (NON-EXTREME) Person

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	26.6	10.0	2.28	.84	.96	.1	1.05	.2
S.D.	2.7	.0	1.39	.17	.35	.6	.69	.8
MAX.	29.0	10.0	3.79	1.10	2.46	2.4	2.99	2.8
MIN.	20.0	10.0	-.84	.65	.39	-1.7	.33	-1.7
REAL RMSE	.90	TRUE SD	1.06	SEPARATION	1.18	Person	RELIABILITY	.58
MODEL RMSE	.86	TRUE SD	1.10	SEPARATION	1.28	Person	RELIABILITY	.62
S.E. OF Person MEAN = .20								

MAXIMUM EXTREME SCORE: 1 Person

SUMMARY OF 49 MEASURED (EXTREME AND NON-EXTREME) Person

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	26.7	10.0	2.33	.86				
S.D.	2.7	.0	1.44	.22				
MAX.	30.0	10.0	5.14	1.88				
MIN.	20.0	10.0	-.84	.65	.39	-1.7	.33	-1.7
REAL RMSE	.93	TRUE SD	1.10	SEPARATION	1.18	Person	RELIABILITY	.58
MODEL RMSE	.89	TRUE SD	1.13	SEPARATION	1.27	Person	RELIABILITY	.62
S.E. OF Person MEAN = .21								

Person RAW SCORE-TO-MEASURE CORRELATION = .98
 CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .73

SUMMARY OF 8 MEASURED (NON-EXTREME) Item

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	126.5	49.0	.00	.33	1.01	.0	1.05	-.1
S.D.	8.5	.0	.85	.04	.20	.9	.34	1.1
MAX.	137.0	49.0	1.49	.41	1.33	1.1	1.61	1.4
MIN.	110.0	49.0	-1.21	.27	.79	-1.1	.67	-1.4
REAL RMSE	.35	TRUE SD	.78	SEPARATION	2.20	Item	RELIABILITY	.83
MODEL RMSE	.34	TRUE SD	.78	SEPARATION	2.34	Item	RELIABILITY	.85
S.E. OF Item MEAN = .32								

Figure 5. Screen capture of teachers' practice in Adiwiyata Curriculum

Figure 5. above shows Person Measure = 2.28 logit, meaning that there is a tendency that the teacher's ability is higher than the items' level of difficulty. Cronbach's Alpha value is 0.73 so that the interaction of people and items is considered good. Although the consistency of teacher answers is deemed to be weak, the person reliability is 0.58, so the quality of items is considered to be good, with item reliability 0.83. The teachers' inconsistency in answering the questionnaire was probably caused by the mindset of the teacher that the team only owned the responsibility for managing environmental education in the Adiwiyata program, so they did not pay attention to the questionnaire items they filled. It makes the teacher's response seem weak, even though the reliability of the instrument is statistically good. The sequence of items from the most difficult to the easiest is presented in the table below:

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	EXACT MATCH EXP.	EXACT MATCH OBS%	Item
8	125	49	1.59	.34	1.03	.3	.99	.0	.50	.51	63.4	Q8
7	131	49	.91	.34	1.16	1.2	1.21	1.3	.34	.46	61.0	Q7
5	132	49	.79	.35	.76	-1.8	.72	-1.7	.63	.45	82.9	Q5
3	137	49	.12	.39	1.24	1.2	1.38	1.3	.21	.40	68.3	Q3
1	139	49	-.20	.42	1.15	.7	.96	.0	.30	.37	75.6	Q1
2	139	49	-.20	.42	.79	-.8	.78	-.6	.51	.37	85.4	Q2
6	143	49	-1.10	.55	.90	-.1	.63	-.5	.37	.28	90.2	Q6
4	145	49	-1.90	.74	.93	.1	.76	.0	.26	.21	95.1	Q4
9	147	49	-3.87	1.82	MINIMUM MEASURE			.00	.00	100.0	100.0	Q9
10	147	49	-3.87	1.82	MINIMUM MEASURE			.00	.00	100.0	100.0	Q10
MEAN	138.5	49.0	-.77	.72	.99	.1	.93	.0			77.7	78.7
S.D.	7.0	.0	1.81	.56	.17	1.0	.24	.9			11.9	9.8

Figure 6. Screen capture of teachers' barrier in implementing Adiwiyata-based curriculum

The figure above shows the difficulties of teachers from the highest to the low are: (Q8): Stimulating students to apply HOTS related to the environment, (Q7): actively involved in handling school waste, (Q5): discussing environmental problems that occur significantly, (Q3): utilizing the environment as learning tools, (Q1): understanding the vision and mission of the environment-based school, (Q2): adapting environment-based learning plan, (Q6): assessing students' attitudes related to the environment, (Q4): linking material with the natural phenomenon, (Q9): cultivating a healthy life habit, (Q10): supporting school environment to be clean and comfortable. The interviews with teachers indicated the desire of teachers to deepen knowledge, especially in making lesson plans that accommodate environmental education. Many of them still think that environmental education can only apply to a few fields of study, although all areas of study can provide it. The best performance teacher in Adiwiyata-based teaching is shown as follows :

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	ZSTD	OUTFIT MNSQ	ZSTD	PT-MEASURE CORR.	EXP.	EXACT OBS%	MATCH EXP%	Person
15	30	10	3.67	1.87			MAXIMUM MEASURE		.00	.00	100.0	100.0	15FC
30	30	10	3.67	1.87			MAXIMUM MEASURE		.00	.00	100.0	100.0	30MB
31	30	10	3.67	1.87			MAXIMUM MEASURE		.00	.00	100.0	100.0	31FB
37	30	10	3.67	1.87			MAXIMUM MEASURE		.00	.00	100.0	100.0	37FC
41	30	10	3.67	1.87			MAXIMUM MEASURE		.00	.00	100.0	100.0	41FC
42	30	10	3.67	1.87			MAXIMUM MEASURE		.00	.00	100.0	100.0	42FC
45	30	10	3.67	1.87			MAXIMUM MEASURE		.00	.00	100.0	100.0	45MD
46	30	10	3.67	1.87			MAXIMUM MEASURE		.00	.00	100.0	100.0	46FD
3	29	10	2.30	1.12	.68	-.3	.35	-.2	.43	.28	87.5	87.4	03FB
4	29	10	2.30	1.12	1.25	.6	1.26	.6	.16	.28	87.5	87.4	04MB

Figure 7. Screen capture of the best teacher in Adiwiyata-based teaching

Figure 7. shows that the highest achievements were carried out by science teacher, social science teacher, social science teacher, science teacher, science teacher, art teacher, art teacher, social science teacher, and social science teacher. Of the ten best teachers, four of them are science teachers, four social science teachers, and two physical-art teachers. Religion teachers are not included in the list, although they also take part in this survey. Further interviews showed that science, social, and art teachers performed well because they mastered environmental concepts and problems, and practice it as part of the material they taught in the classroom.

The student's environmental awareness questionnaire addresses environmental topics that are national and international issues. Indonesia is the largest archipelago country in the world, with a large population. Rapid economic growth is thought to damage the environmental balance. The OECD 2019 states that with changes in land use that have shifted to industrial interests and dependence on fossil fuels, Indonesia has become one of the most significant contributors in the world to greenhouse gas emissions. Pressure on ecosystems caused by deforestation and pollution has harmful effects on the environment (OECD, 2019). Water supply, sanitation, and sewage treatment must receive special treatment and be a priority. The existence of environmental education through Adiwiyata with full support from the community and schools is needed so that environmental awareness becomes a culture so that Indonesia continues to develop towards a green economy, with strong policies, credible institutions, and certainty in the availability of resources.

In general, the constraints for students' environmental awareness are students' ignorance of the latest environmental issues and problems that occur globally. Therefore environmental literacy in teachers and students must be empowered. Practically they should increase the intensity of discussion and formulation of learning problems based on environmental cases. Daily habits that have the potential to damage the environment must be socialized, for example, the use of disposable plates, perfume, disposing of electronic waste such as cables, used lights, and so on carelessly. Appropriate references on environmental issues must also be disseminated to both teachers and students, especially reputable national and international news sites. To ensure that the Adiwiyata program runs optimally, teacher's knowledge of environmental issues and how to shape the character of environmental awareness in and outside the classroom is essential. Evaluation of environment-based learning must be carried out continuously and periodically.

There is a tendency that environmental awareness increment is in line with school consistency in upholding the Adiwiyata program. Teachers' readiness and motivation to develop environmental-based learning competencies, as stated in the Adiwiyata are vital. These findings can be used as the basis for further research, especially in students'



environmental awareness development through the integration of environmental education content in learning, school culture, and environmental conditioning involving students' families and the communities.

CONCLUSION

The results show that the two partner schools have gradually but consistently prepared and adapted the Adiwiyata program in their environment. Schools have made adjustments through changes in vision and mission and teacher readiness in adapting Adiwiyata-based learning instruments. Measurements of students' environmental awareness have also been carried out so that the school gets any input that needs to be improved. Most of the teachers have tried to insert environmental parts into their learning kits, both in the form of assessment instruments or as media; however, there are differences in teachers' viewpoints relating to their field of study. Adiwiyata-based learning tools with the best categories are dominated by science, social science, and arts teachers. Meanwhile, the level of environmental awareness of students was high, especially among female students. The highest level of environmental awareness is dominated by students from senior high school, especially in grades 11 and 10.

ACKNOWLEDGMENTS

This article is an outcome of a community partnership program, supported by Penerimaan Negara Bukan Pajak Universitas Sebelas Maret (PNBP UNS) through the Cluster of Research Group Biology Education. The authors would like to express sincere gratitude to the Research Institutions and Community Service of Universitas Sebelas Maret (LPPM UNS), Indonesia.

REFERENCES

1. Cavanagh, R. F., & Waugh, R. F. (2011). Applications of Rasch Measurement in Learning Environments Research. *The British Journal of Psychiatry* (Vol. 112). Rotterdam: Sense Publishers.
2. Coertjens, L., Boeve-de Pauw, J., de Maeyer, S., & van Petegem, P. (2010). Do Schools Make a Difference in Their Students' Environmental Attitudes and Awareness? Evidence from PISA 2006. *International Journal of Science and Mathematics Education*, 8(3), 497–522. <https://doi.org/10.1007/s10763-010-9200-0>
3. Cresswell, J., Schwantner, U., & Waters, C. (2015). A Review of International Large-Scale Assessments in Education: Assessing Component Skills and Collecting Contextual Data. PISA, The World Bank. Paris: OECD Publishing.
4. Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Research design Qualitative quantitative and mixed methods approaches. California: SAGE Publication.
5. Edwards, J. (2016). *Socially-critical Environmental Education in Primary Classrooms The Dance of Structure and Agency*. Switzerland. Retrieved from Springer International Publishing
6. Ham, M., Mrcela, D., & Horvat, M. (2016). Insights for Measuring Environmental Awareness. *Ekonomski Vjesnik*, 29(1), 159–176.
7. Kementerian Lingkungan Hidup Indonesia. Undang-undang Pengelolaan Lingkungan Hidup No. 23 Tahun 1997 (1997). Indonesia.
8. Kementerian Lingkungan Hidup Indonesia. Undang-undang Republik Indonesia Nomor 32 Tahun 2009, 32 § (2009). Indonesia.
9. Kementerian Lingkungan Hidup Indonesia. Peraturan Menteri Lingkungan Hidup Republik Indonesia No. 05 Tahun 2013 tentang Pedoman Pelaksanaan Program Adiwiyata (2013).
10. KLH, & Kemendikbud. (2017a). *PANDUAN ADIWIYATA “Sekolah Peduli dan Berbudaya Lingkungan.”* Jakarta.
11. KLH, & Kemendikbud. (2017b). *Suplemen 1 Buku Panduan Adiwiyata tentang Penjelasan Pencapaian Sekolah Adiwiyata*. Jakarta.
12. Lashchinskiy, N. N., Zolnikov, I. D., Glushkova, N. V., & Lashchinskaya, N. V. (2016). A New Method for Evaluating the Degree of Anthropogenic Transformation of Suburban Woodlands, 9(5), 636–642.
13. Mogome-Ntsatsi, K., & Adeola, O. A. (1995). Promoting environmental awareness in Botswana: the role of community education. *The Environmentalist*, 15(4), 281–292. <https://doi.org/10.1007/BF01902250>
14. Nagra, V. (2010). Environmental education awareness among school teachers. *Environmentalist*, 30(2), 153–162. <https://doi.org/10.1007/s10669-010-9257-x>



15. OECD. PISA : Results in Focus (2018).
16. OECD. (2018b). Pisa 2018 Draft Analytical Frameworks May 2016 : Paris.
17. OECD. (2019). OECD Green Growth Policy Review of Indonesia 2019. OECD Environmental Performance Reviews. Paris: OECD Publishing.
18. PISA. (2006). Assessing Scientific , Reading and Mathematical Literacy, A Framework for PISA 2006. Paris: OECD.
19. Reckase, M. D. (2009). Multidimensional Item Response Theory. Multidimensional Item Response Theory. New York: Springer Science+Business Media.
20. Singh, P. (2013). Environmental Education: Enhancing Learning and Awareness Through Assessment. Systemic Practice and Action Research, 26(3), 299–314. <https://doi.org/10.1007/s11213-012-9252-x>