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Education for Sustainable Development as Diffusion of Innovation of Secondary School Students

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Abstract

Education for sustainable development (ESD) is essential to study in order to understand environmental changes from the perspective of student character building. This concept is the main foundation that refers to individual personality as a medium to build excellent capacity from an early age. At adolescent age, children experience a period with high emotional growth that encourages changes in attitudes and behavior patterns towards the surrounding environment. This exploratory study aimed at describing the relationship between environmental knowledge and students' attitudes and behaviors, along with challenging factors as the moderating variable, involving 320 participants from two junior high schools in two cities in Central Java, Indonesia. The data were analyzed using partial least square Smartpls v3.0. This study found that junior high school students had low environmental and social knowledge, but there was a good attitude and behavior tendency concerning the environment. The students' knowledge significantly influenced environmentally-friendly attitudes and behaviors, especially the social environment that the obstacles also became a significant moderating variable. Thus, schools and related parties should develop programs to increase the students' study orientation towards the environment and to have a collective awareness of the environment, specifically the ability to analyze and synthesize the surroundings.

Key words: attitude, behavior, education for sustainable development, knowledge

Introduction

Around 200 million children are born each year and they are threatened to not obtaining moral education and cognitive development during their growth because of poverty, poor health, and inadequate care (Grantham-McGregor et al., 2007) especially in Africa (Nicole D Ford & Aryeh D Stein, 2016). It has an impact on the individuals' ability to develop their potential and to encourage processes in order to maintain peace

and understand the importance of sustainable development. Hence, the United Nations recognize education as their top priority (United Nations, 2017). The rapid human growth without strong moral and cognitive foundation has an impact on activities involving the surrounding environment. Meanwhile, the most of the activities causing the increased temperatures across the world and environmental damage were caused by humans (Azabany et al., 2016). Environmental change can be understood as a basic thing that should be considered as a whole interaction used by humans in carrying out their activities. Hence, humans need to acknowledge their actions that have impact on their environment from an early age through education for sustainable development (ESD) which is taught gradually and consistently, not only involving oneself but also the surrounding community. ESD helps individuals reflect their current actions on the future and from a narrow to broad scale (United Nations, 2017).

From a conceptual point of view, individual development consists of processes throughout life, including physical, behavioral, cognitive, and emotional growth and changes in the form of self-actualization. Through this process, each individual strives to become a better version of himself every day (Jain, Apple, & Ellis, 2015). The process reaches the optimum level when an individual reaches adolescence. Adolescents experience this condition at a formal operation phase (11 years to adults), in which individuals can think abstractly and make reasoning to find the root cause of a problem or sophisticated thinking (McDonald et al., 2014; Siraj-Blatchford, Smith, & Samuelsson, 2005). Adolescence is a marker of individual change due to the fluctuation of emotional condition along with the emergence of conforming and contradictory values (Larson & Brown, 2007). At this phase, an individual will confirm his cognition which is called the process of metacognition (Flavell, 1979). The surrounding people's reaction becomes a learning experience for adolescents to determine what actions they will take in the future so that the individual mental development will be directly influenced by the surrounding people (Zen et al., 2016, 2019).

ESD is required to improve the individuals' capacity and commitment in building sustainable societies (Lavanya & Saraswathi, 2014), which cannot only be made through a short training. ESD is not merely the result of formal education (Prabawani et al., 2017) because students' knowledge of the environment influences their ability to analyze and synthesize what happens to their environment. This is important so that environmental knowledge can provide opportunities to manage emotional growth in oneself. Moreover, ESD is an educational program to teach individuals from an early age to reduce individual dependence on natural and social resources (Siraj-Blatchford et al., 2005). Therefore, this study will present how the students' environmental knowledge influences their attitudes and behaviors towards the environment with challenges as inter-skill and knowledge without values can lead to disastrous results and the present.

This study contributes to ESD competencies by developing a basis for individual value system. ESD competencies aim at empowering a learner to take own action in the form of sustainable manner by taking into account their current and future social, cultural, economic and environmental impacts from both a local and a global perspective (Rieckman, 2018). Individual value system connects the skill and knowledge towards action or environmental behavior for sustainable future that we want (Jetly & Singh, 2019). The process is possible through student's participation at school as part of school transformation process in one of the case studies in Lithuania (Valackienė & Kairienė, 2019). 'Practice their Preach' has become a trend in education in the form of living lab for education for sustainable development (Zen, 2017).

Literature Review

In contrast to Environmental Education (EE) which is oriented to mastering environmental knowledge, ESD requires participation, self-awareness, and independent thinking, as well as pedagogical approaches that lead to behavioral change. ESD is implemented differently in each country with different challenges (Stapp, 2000). In Indonesia, ESD is implemented through a program called *Adiwiyata*, which is a collaborative program between the Ministry of Education and Culture and the Ministry of Environment that covers social, environmental, and spiritual aspects. *Adiwiyata* starts from the regional/city, national and ASEAN levels. The substance of ESD are, not limited to, the knowledge of climate, health, equality, population, peace, and environmental education (Stapp, 2000). It also focuses on the balance of environmental, social, and economic interests (Stapp, 2000; Werbach, 2009).

ESD is constrained by time, resources, capacity, organizational supports, and instructional standards (Cebrián, Grace, & Humphris, 2015). It should be noted that even academic staff do not understand the concepts of ESD sufficiently (Cebrián et al., 2015; Sinakou, Pauw, Goossens, & Petegem, 2018), and there is low government commitment and media attention to ESD (Ors, 2012). For example, media more often raise school academic achievements than the achievement of its environment. However, ESD studies for primary and secondary high schools are limited so that similar studies are needed as an evaluation material for the implementation of ESD. Meanwhile, there are three important components that impact the students' behavior and last throughout their lives for the implementation of environmental-based education. These components are attitude, knowledge, and awareness (Vega, 2004).

Knowledge of ESD can be reviewed through two perspectives: socio-cultural and environmental perspective. Socio-cultural perspectives include human rights, peace, security, gender equality, cultural diversity, and intercultural understanding, health, HIV/AIDS, governance. Environmental perspectives include natural resources (energy, water, agriculture, and biodiversity), climate change, rural development, sustainable urban communities, disaster prevention, and mitigation. (Michalos, Creech, McDonald, & Kahlke, 2011).

Attitude is an obtained value, feelings of worry, and motivation for participation in environmental progress and protection (Vega, 2004). Attitude is a tendency to behave in a certain way in relation to specific stimuli, internal and external situations (Cebrián & Junyent, 2015), as a result of individual evaluations of objects, people, and events. Teenagers' attitudes, knowledge, behaviors, and concerns towards the environment would directly or indirectly influence a future decision making about natural resources and how the resources are used responsibly and sustainably (Meinhold & Malkus, 2005). Individuals who have high confidence and control in their ability to execute and complete tasks show a tendency towards participation in pro-social behavior. This behavior aims at helping or benefiting individuals and groups and contributing to self-efficacy of the students who reflect their own motivation, behavior and social environment (Pröbstl, & Schmidt-Hönig, 2019). There is a higher level of youth confidence when participating in pro-social activities. This must be similar to the feelings and confidence they have when participating in pro-social activities on the environment.

The challenge of educational institutions in ESD is to critically assess ESD programs that have been run and re-orient the current approaches so that they are fully bonded with the sustainability agenda (Jones, Trier, & Richards, 2008). The challenges are

identified with the desire to inform and encourage the academic community to develop the future sustainability formula. The challenges in ESD are distinguished into internal barriers related to individual thought patterns and personal motivation, and external factors that raise issues related to organizational and institutional structures (Jones et al., 2008).

Method

This research applied an exploratory study using questionnaires as the data collection method. Different from the study of Michalos et al. (2011) that distinguished knowledge, attitudes, and behaviors between adults and student ages, this study focused on the influence of knowledge, attitudes, and the challenges towards student behavior on the environment. The questionnaire was innovated based on the behavioral indicator of environmentally friendly and the attitudinal aspect based on the study in the junior high school (Fitriani, 2017). However, the studies were carried out at different levels; therefore, this study conducted an initial screening at junior high school and discussed the subject with teachers in the area of study. The study locations were two junior high schools in Salatiga and Semarang in Indonesia with a total of 336 respondents involved in the study. The cities of Semarang and Salatiga were chosen as the population of study because these were urban areas, heterogeneous, and had similar socioeconomic levels. The similarity of characteristics was important to avoid bias. In more detail, the description of the study respondents is as follows:

Table 1
Respondent Identity

	Description	f	%
Grade	IX	108	32 %
	VIII	118	35 %
	VII	110	33 %
City	Salatiga	188	56 %
	Semarang	148	44 %
Total		336	

Referring to the table above, there was an even-distributed number of students from two different cities and an even distribution from different grades, namely 7th, 8th, and 9th grades. Even distribution was applied to ensure equal representation between classes. This was necessary because students' natural and social knowledge may be influenced by the level of the respondents' grade. Furthermore, the data were processed using frequency distribution and Smartpls v3.0 to find the correlation and relationship between variables. They were the influence of students' knowledge related to the environment and towards the environmentally-friendly behavior through attitude as an intervening variable and obstacles as a moderator between students' knowledge and attitudes.

The indicators of this study were relatively simple, in which the knowledge variable was measured from students' knowledge on climate, waste, natural resources, food, and social conditions. These four types of knowledge are representations of planets and people in the triple bottom line. The challenge was measured from study orientation and collective awareness regarding the surrounding environment. The attitude was

measured from the students' opinions on cleanliness, especially waste around the school. Behavior was also measured from the students' behaviors concerning the natural and social environment.

There were different scales for each variable, in which behavior was measured using an ordinal scale with options: "never" (score 1), "sometimes" (score 2), and "always" (score 3). The attitude was measured using an interval scale, namely "strongly disagree" (score 1), "disagree" (score 2), "agree" (score 3), and "strongly agree" (score 4). Knowledge was measured using a ratio scale that the score was the sum of students' correct answers in which the scores were between 0 and 25. Furthermore, the data were processed using frequency distribution and partial least square using Smartpls v3.0 to test the exploratory model.

Results and Discussion

The findings of this study will be presented into several segments; they are the frequency distribution of each variable followed by a model that explains the correlation among variables. The frequency distribution will present the percentage and average values of each questionnaire item related to students' knowledge, attitudes, behaviors, and obstacles in adopting environmentally-friendly behavior. Meanwhile, the model will present the influence of knowledge and obstacles to environmentally-friendly behavior towards the students' attitudes as an intervening variable.

Knowledge

This study found that students' overall knowledge of natural and social environmental materials was low, i.e., the average population score was only 45.8 out of 100. On average, students were only able to answer correctly 11 out of a total of 25 questions.

The indicators of natural and social environmental knowledge assessed students' knowledge of natural resources, climate, social, waste, and food.

Table 2

Knowledge Indicators

Natural resources <ul style="list-style-type: none"> • (Un)Renewable resources • Industrial forest • Conservation 	Waste <ul style="list-style-type: none"> • Dangerous waste • Recycle, Reduce, and Reuse • Pollution
Climate <ul style="list-style-type: none"> • Air temperature • Environmental changes 	Food <ul style="list-style-type: none"> • Hygiene • Healthy food • Addictive substance
Social <ul style="list-style-type: none"> • Norms • Interpersonal relation 	

The students' best knowledge was on the social dimension with a score of 58.0, and the lowest was on the waste dimension with a score of 36.9 as described in the following table:

Table 3
Knowledge

Knowledge	Nat resources	Waste	Climate	Food	Social	Total (Average)
Total questions	5	10	4	3	3	25
Score	2.6	3.7	1.9	1.4	1.7	11.4
Grade	52.9	36.9	48.2	47.9	58.0	45.8

Attitudes

The students’ attitudes related to environmental care were measured using an indicator of students’ perception of waste and cleanliness. This variable showed a good average score of 3.28 out of 4.0. All indicators also had a relatively similar average range, ranging from 3.16 to 3.34. It showed that students had good attitudes concerning waste, although 5 % and 8 % of students, respectively, did not care and did not even care about waste. The details of students’ attitudes are as described in the following table.

Table 4
Environmental Attitude

Attitudes	VUC	UC	C	VC	Average
A1 Wet and dry waste needs to be separated	4 %	4 %	48 %	45 %	3.34
A2 Helping to dispose waste in their place	6 %	9 %	49 %	37 %	3.16
A3 Proud if the environment is clean	9 %	7 %	25 %	58 %	3.32
Average	5 %	8 %	44 %	43 %	3.28

Note: VUC: Very Uncare, UC: Uncare, C: Care, VC: Very Care

The students’ good attitude towards the environment, concerning waste, showed that students could analyze the existing phenomena sufficiently.

Behavior

The environmentally-friendly behavior of junior high school students showed a relatively high average score of 2.58 out of 3.0 for behavior related to the natural environment, and 2.70 out of 3.0 for behavior related to the social environment. Regarding the natural environment, only 2 % of students stated that they had never behaved well. Likewise, only 3 % of students stated that they had never behaved well in their social environment. However, only 60 % and 73 % of students always behaved well toward their environment. The details of student behavior towards their environment are described in the table below.

Table 5
Environmentally Friendly Behavior

Natural environment	Never	Sometimes	Always	Average
B1 Disposing waste in the right place	0 %	50 %	50 %	2.49
B2 Maintaining the wall cleanliness	4 %	26 %	70 %	2.66
Average	2 %	38 %	60 %	2.58

See next page for continuation of table

Continuation of Table 5

Social environment	Never	Sometimes	Always	Average
B3 Returning the borrowed stationery	4 %	26 %	71 %	2.67
B4 Not playing truant	2 %	23 %	75 %	2.72
Average	3 %	25 %	73 %	2.70

The students' positive behavior was slightly better in the social dimension than in terms of natural dimension, i.e., most students returned the borrowed stationery and did not play truant. In the natural dimension, students behaved a little better in maintaining the cleanliness of the walls than in disposing of waste.

Challenge

Concerning environmentally-friendly behavior, junior high school students cannot be separated from the supports or obstacles they faced from their environment. They are families, peer groups, neighborhoods, work organizations, and educational institutions (teachers, friends) (Settersten, 2002). These peer groups will form the students' orientation, sensitivity, attitude, and behaviors.

This study found that there were obstacles in performing environmentally-friendly behaviors especially in terms of students' mutual awareness which was low – 8 %. Besides, there were obstacles in students' study orientation that ignored environmental awareness. Details of the obstacles experienced by students are provided in Table 6.

Table 6
Challenges

Challenge	Low	Medium	High	Average
C1. Study orientation to environmental care	59 %	35 %	6 %	1.47
C2. Mutual awareness	49 %	43 %	8 %	1.59
Average	54 %	39 %	7 %	1.53

The data above also show that only 6 % of students had a high study orientation to environmental care, while the rest were still oriented to academic achievement, which led to the mastery of knowledge materials or awareness-to-knowledge. The average high study orientation and mutual awareness as ESD obstacles were only 1.53 out of 3.0 scale. This challenge had the potential to further impede students' how-to-knowledge (behavior) processes on the environment, so the lower the awareness-to-knowledge (knowledge), with higher barriers, the lower the how-to-knowledge (attitude) (Prabawani et al., 2017; Rogers, 1983; Sterling, 2010).

ESD Model

ESD model aimed at testing students' how low awareness-to-knowledge influences the students' attitudes (how-to-knowledge) and behaviors (principle-to-knowledge). The students' attitude here acted as an intervening variable. The challenges as a moderating variable could strengthen or weaken the influence of knowledge on students' attitudes and behaviors towards their environment.

The variable validity and reliability were as follows in this study:

Table 7
Validity and Reliability

Latent variable	R ²	AVE	Composite reliability
Knowledge	–	0.623	0.891
Challenge	–	0.602	0.749
Attitude	0.127	0.520	0.765
Natural behavior	0.044	0.536	0.697
Social behavior	0.152	0.691	0.816

The table above shows that the composite reliability of each variable was more than 0.6. It means that there was reliability from indicators to explain each variable in this study. The study indicators were valid as indicated by the average variance extracted (AVE) of all variables with a value of more than 0.5. This means that the indicators could measure correctly the latent variables and unidimensional (Bagozzi & Yi, 1988; Hair, Black, Babin, Anderson, & Tatham, 2006). However, the R² values for the attitude, also for the natural and social behavior were low. The indicators to measure latent variables were as follows:

Table 8
Research Indicator

	Loading	Sig.
Knowledge		
• Climate	0.821	27.933
• Waste	0.695	12.094
• Food	0.734	17.957
• Natural resources	0.872	47.418
• Social	0.812	29.156
Attitude		
• Waste separation A1	0.763	14.970
• Waste disposal A2	0.682	11.262
• Cleanliness A3	0.717	13.978
Challenge		
• Study orientation C1	0.676	4.544
• Mutual awareness C2	0.864	10.578
Behavior on nature		
• Disposing waste into garbage bin N1	0.788	4.954
• Maintaining cleanliness N2	0.672	2.935
Behavior on people		
• Returning stationery S1	0.886	24.554
• Avoiding truant S2	0.772	10.521

The indicators above were also able to explain the latent variable indicated by a relatively high cross-loading value, which was between 0.672 and 0.886. All indicators were valid with a significance value of >1.976. The details of each cross-loading, the influence among variables, and their significance can be seen in the model below.

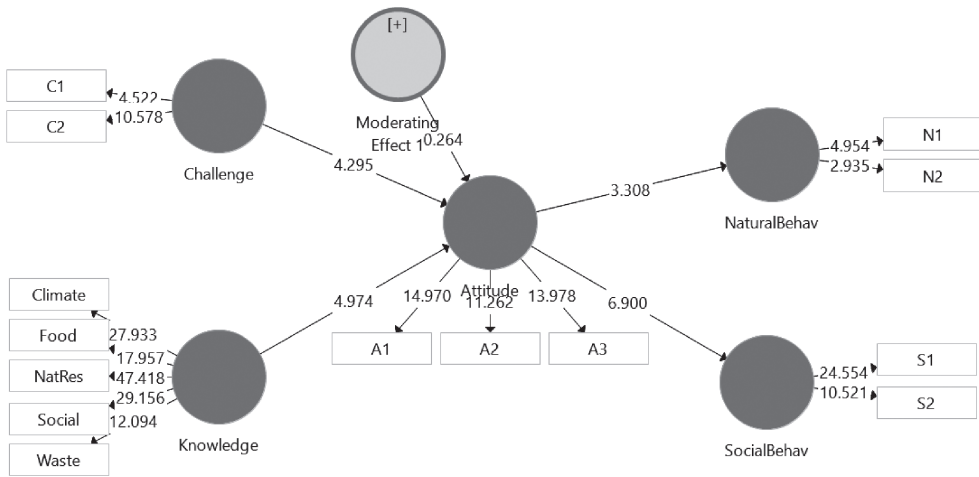


Figure 1. The influence of knowledge on environmentally-friendly attitudes and behaviors with challenges as a moderating variable

The model shows that knowledge influenced attitude significantly, and subsequently, attitude also influenced the natural and social behaviors significantly. However, the challenge did not significantly become a moderating variable of knowledge and attitude. It meant that the existence of obstacles in adopting environmentally-friendly behavior neither strengthened nor weakened the students’ attitudes and behavior. In more detail, the correlation among variables from the above model above can be presented in Table 9.

Table 9
Smartpls Output

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Attitude -> NaturalBehav	0.210	0.226	0.063	3.308	0.001
Attitude -> SocialBehav	0.389	0.397	0.056	6.900	0.000
Challenge -> Attitude	-0.245	-0.246	0.057	4.295	0.000
Knowledge -> Attitude	0.250	0.260	0.050	4.974	0.000
Moderating Effect 1 -> Attitude	0.016	0.024	0.060	0.264	0.792

The table above shows that the students’ knowledge influenced the attitude and the natural and social behaviors significantly. Similarly, the students’ challenge to adopt environmentally-friendly behavior also influenced the students’ attitude. The significance value for the knowledge on attitude, attitude on the natural and social behavior, as well as the challenge to the attitude were 0.000 to 0.001. However, the challenge did not significantly act as a moderating variable between the knowledge and the attitude. The original sample value indicated positive relationship orientation for knowledge-to-attitude, attitude-to-natural and social behaviors. This shows that knowledge, which was divided into knowledge on climate, food supply, natural resources, social welfare, and waste had a positive and significant influence on the dependent variables, i.e., attitude, natural and social behavior. Similarly, the attitude had a positive and significant

influence on the behavior. It meant that the better the students' attitude, the better their social behavior. The p-value resulted from the influence of the challenge towards attitude, which was 0.064. However, the original sample value for the challenge-to-attitude was negative. This revealed a reciprocal relation between the variables – if the challenge was greater, the attitude of the students towards the environment would be lower.

The p-value for the challenge as the moderating effect was greater than 0.05 so that the influence of challenge towards the attitude was not significant. It meant that the challenge did not influence the students' attitude towards the environment, in contrast with the challenge it acted as an independent variable that influenced the attitude and the behavior. This revealed that the challenge was not relevant to be considered as a moderating variable but as an independent variable.

The results can be explained by the Theory of Diffusion of Innovations (Rogers, 1983). In relation to ESD, it is relevant not only to elementary school students (Prabawani et al., 2017) but also to students at primary school. Unfortunately, students' knowledge of environmentally-friendly knowledge was still low and schools still only focused on mastering educational materials that were oriented towards school grades. Although students' attitudes were relatively good in relation to the environment, their effect was small on the changes in environmentally-friendly behavior. This was unfortunate considering that adolescence was the right and significant time to form personal and environmentally-friendly behavior. This time is a period of human development to find the root of the problem by doing metacognition (Flavell, 1979) through developing analytical abilities and in relation to ESD as an early majority (Rogers, 1983).

Higher influence of attitude on social behavior could be explained by the pressure of overpopulation and poverty that pushed the New Order Government in Indonesia to exploit nature for foreign currencies (Grantham-McGregor et al., 2007; Nomura, 2009), called "community problem solving" (Stapp, 2000). This, in relation to ESD, encourages education to be more concerned about the social aspects, although it does not necessarily ignore the natural issues. Thus, social values that prioritize relationships between individuals, especially relationships with seniors, friends, and maintaining manner, are more of major concern. In the context of Javanese culture (including Semarang and Salatiga as the locus of this research), *unggah ungguh* is indeed an important manner in interpersonal life due to the moral decline resulted from overpopulation and poverty (Kusumaningputri & Widodo, 2018).

The Indonesian government needs to further promote, create commitments, design regulations, facilitate and develop programs that link EE to ESD (Stapp, 2000). Previously, the Government of Indonesia through a collaboration program between the Ministry of Education and the Ministry of Environment had spawned thousands of Adiwiyata-honored schools at the regional, national and even international levels. However, the results were unsatisfactory.

Low mutual awareness and environmental disorientation indicated no or low commitment from academic staff towards ESD. This could be reviewed from the academic staff who were more focusing on academic achievement; environmental aspects were only conveyed as insert material when teaching. In a society that did not understand ESD, making Adiwiyata status was not a pride. Even the Adiwiyata School was no longer assumed as an achievement but an obligation. No doubt, many schools did not seem to be serious about running the Adiwiyata program. Moreover, there was no periodic supervision and adequate training from relevant agencies so that the implementation of

Adiwiyata was less than optimal. Thus, it is necessary to establish an Adiwiyata Monitoring Team from the Ministry of Education and Culture and the Environment Office to oversee the implementation of Adiwiyata activities to make sure the program would be implemented well.

Conclusion

The significant influence between knowledge on students' attitudes and behavior towards the environment should encourage schools and related parties to increase the students' awareness-to-knowledge with a variety of appropriate education and teaching methods. This is essential as the study found low levels of student knowledge in relation to the environment. The existing challenges, which were limited to the orientation of learning and shared awareness, had no significant influence on students' attitudes and behavior. It was necessary to explore other barriers that had the potential to affect students' environmentally-friendly behaviors. Likewise, future studies need to enrich indicators and not only use self-administered surveys independently filled by students, as the behavior is not enough to only be evaluated by self-assessment.

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