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Systems Thinking and Leadership of Teachers in Education for Sustainable Development: A Scale Development

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Abstract: This study aims to develop scales to measure teachers' systems thinking and leadership in education for sustainable development (ESD) at an environmental care and culture school, which is important because the school serves as an ESD benchmark for other public schools. However, there is no adequate performance measurement scale that incorporates the three dimensions of the triple bottom line (TBL). The 133 samples in this study were collected from four schools in regencies and cities in Indonesia. We developed a scale to measure teachers' systems thinking and leadership in ESD. The developed scale was then tested using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). We found that the teachers had the lowest performance in systems thinking competence compared to other competences, such as ability to plan content and social dimensions. The teachers set a good example by using polite language and gestures but did not model green behavior. The teachers also had low scores in peer participation in external organizations and activities. The scale formulated in this study can be used to measure teacher performance in ESD, although some indicators must be further developed. In the future, purely confirmatory studies can validate the dimensional structure of this exploratory factor analysis.

Keywords: education for sustainable development; teachers' competence; systems thinking; leadership; scale development



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Citation: Prabawani, B.; Hadi, S.P.; Zen, I.S.; Hapsari, N.R.; Ainuddin, I. Systems Thinking and Leadership of Teachers in Education for Sustainable Development: A Scale Development. *Sustainability* **2022**, *14*, 3151. <https://doi.org/10.3390/su14063151>

Academic Editors: Rosabel Roig-Vila, Jordi M. Antolí-Martínez, Antonio Cortijo, Vicent Martines, Santiago Mengual Andrés, Elena Sánchez-López, Fabrizio Manuel Sirignano and Alexander López Padrón

Received: 11 January 2022

Accepted: 24 February 2022

Published: 8 March 2022

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1. Introduction

It is especially for young people to have awareness and knowledge of environmental changes and damage in order to protect the natural and social environment [1–3]. Formal education is the main media for knowledge sharing, through the development of critical thinking [4], in situations that are often unfavorable [3]. Formal education is useful not merely for cognitive knowledge but also for strengthening social relationships through interactions between individuals to create common awareness [3]. Education forms with the goal of moving society towards sustainable development are usually known as education for sustainable development (ESD) or education for sustainability (EfS) [5,6]. Formal education in schools in the context of ESD comprises the ability to think, behave, and act in a way that is responsive towards the environment [3].

Realization of the 2030 Agenda for Sustainable Development through education for sustainable development (ESD) was emphasized in goal 4 [7], which is to ensure that learners receive education that is inclusive, fair, and promotes lifelong learning opportunities for all. Every student at all levels of education is expected to be able to improve skills associated with economic growth, social development, and environmental protection. To achieve this

new agenda requires the participation of multi-parties on micro level (individual/student), meso level (school, education, training) and macro level (government). The fourth SDG (sustainable development goal) indirectly targets skills of students and teachers [8]. However, the targets and indicators of SDG achievement are different from those of sustainable development oriented to the triple bottom line (TBL), i.e., people, planet, and profit. Goal 4 of the SDGs is encompassed as a single indicator, which is less relevant to the TBL concept. Unfortunately, research related to ESD often focuses on comparisons between countries at the level of students and does not consider the teachers. As active change agents, teachers play a central role in ESD. Not only do they contribute to the development of knowledge and changing attitudes in schools but also in daily life [2,3,9,10]. Therefore, teachers need to be able to develop innovative education [4] and to play a role not only as translators but also interpreters of knowledge [3]. The capacity required by the teachers in the context of sustainable development includes systems thinking, values thinking, futures thinking (anticipatory), strategic thinking (action-oriented), and collaborative (or interpersonal) thinking [11–13]. Unfortunately, ESD references and modules are limited, which makes it difficult for teachers to adopt them in the curriculum, even in developed countries and higher education [14]. For example, secondary school teachers in Poland were not well prepared to include the ESD agenda in the curriculum, did not feel that it was necessary to cover the ESD agenda, and only a few attended ESD training. These Polish teachers did not have adequate knowledge and understanding of ESD, such as its principles, goals, and the urgency of the program, and therefore did not prioritize its educational programs [3]. As a result, ESD was delivered with unattractive and ineffective methods. Meanwhile, a study in Pakistan showed that teachers who obtained ESD education had a better attitude towards the natural and social environment and included such issues in the curriculum [2]. Teachers in Canada reported difficulties gaining experience in environmental studies, particularly for educating students with diverse cultures and received ESD training only from books and TV [15]. This is an unfortunate condition because teachers' preparedness fundamentally influences the effectiveness and learning outcomes of ESD [16].

In Indonesia, ESD has not received sufficient attention from the government, the education sector, or the public. Indonesia has been designated as one of the top emitters of CO₂, along with China, Brazil, and India, due to its high population and energy-intensive industrial sectors [17]. ESD is an optional program for schools and requires extra work from institutions and teachers. ESD is considered a non-urgent agenda due to the fact that the Ministry of Education and Culture has not set formal regulations about it. Instead, environmental education is regulated by the Ministry of Environment and Forestry through the Adiwiyata School (also known as Green School), program, which promotes an environmentally friendly culture in schools. Adiwiyata School promotes responsible protection of the environment through good school governance to support sustainable development. The Ministry of Environment and Forestry provides guidance, conducts annual assessments of school performance in the implementation of environmental education through environmental cultural movements, and acknowledges programs such as Adiwiyata School with awards [18]. This present study is essential because until now, environmentally friendly education has not succeeded in changing human behavior [19]. Within the framework of systems thinking, the idea that nature is a large system, ESD is part of a complex and holistic system. Systems thinking builds a foundation for change by formulating what is desired, identifying existing conditions, setting change commitments, and ultimately making efforts toward improvement based on the theory of change [19].

In addition to systems thinking, teachers are required to have leadership, or teaching leadership. Sustainable leadership embodied in teaching leadership is important to create an ESD-effective school [20]. Teachers' leadership is needed in ESD so that teachers can establish communication with various education participants, both individually and collectively and influence them to improve the quality of students' learning and achievement [21]. Teachers' leadership involves competence beyond regular teaching duties [21]. Therefore, this study aims to analyze teachers' systems thinking and leadership at environmental

care and environmentally friendly cultured schools. This study is expected to serve as a benchmark for schools that have not implemented ESD practices. This research is important since teachers in ESD have an essential role in creating future leaders [2,22].

2. Materials and Methods

ESD is a process of equipping students with the knowledge, understanding, skills, and attributes required to work and to live in a way that can also protect the natural, social, and economic environments, both for present and future generations, considering local and global perspectives [4,5,7]. ESD is expected to encourage students to reflect on the impact their actions have on their environment in a more complex manner and to participate in socio-political processes (United Nations, 2017). In addition, ESD aims to ensure that people, as global citizens, environmental stewards, and social justice collaborators [1,4], are better prepared to face future challenges [10]. It is essential to integrate ESD across all subjects in order to develop teachers' professionalism and to ensure that ESD practices can be properly implemented [23]. Public concern towards ESD is increasing, as indicated by the UNESCO declaration on ESD, and more schools have applied ESD into their school curricula [24], particularly in the agricultural and natural resources sector, especially after 2005, although there has not been any improvement in teaching and learning strategies [25].

The teachers in this study have a fundamental role in shaping the students' attitudes and behavior by their systems thinking and leadership skills, while the proxies of these two variables have not been widely developed in the implementation of ESD, specifically in Indonesia. Hence, this study aimed to develop a scale for the teachers' systems thinking and leadership in ESD. Furthermore, we applied factor analysis in an exploratory study to obtain an initial measurement. Then, SEM using AMOS was applied to confirm the findings and to increase the generalizability of the measurement. The development of a measurement scale aimed to measure systems thinking and leadership in education for sustainable development was initiated by conducting some activities from literature reviews, collecting data, and then validating them using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) [26,27].

Systems thinking in ESD is defined as the ability of teachers to comprehend and to solve problems thoroughly by using components and interconnecting those involved in the system [28]. To provide a holistic understanding, teachers are required to be able to plan and implement the content of learning to ensure that the material is comprehensive and thus the students will be able to find the root cause of unsustainable development [29]. In this study, comprehensive material is manifested in the form of content about the planetary dimensions, such as air, water, and noise pollution, as well as natural resources scarcity. Moreover, the people dimension focuses on current social issues from drugs and smoking and free sex to bullying, which are relevant, especially for teenagers.

Teachers' leadership refers to the ability of teachers to influence co-workers, superiors, parents, and other members of the school community to improve teaching and learning practices in order to enhance students' learning and achievement [30] in ESD. This variable can be investigated from social structural and psychological perspectives and is not merely a learning subject in the classroom. Teachers' leadership is implemented by participating in professional learning and organizations to encourage shared policy and decision making. This should take the form of peer participation, i.e., the teachers' participation in various activities, discussions, and social and environmental organizations, as well as providing input for internal and external colleagues. Teachers' leadership is also shown by conveying and applying environmental principles into classroom practice and establishing close relationships with students [31], as well as creating a positive environment for students [32]. This is reflected by a variety of simple models of teachers' behavior in the classroom, such as the use of polite language, punctuality, and the use of non-disposable bottles.

We applied a survey using a questionnaire as the primary data in this study. The proxies of systems thinking and teachers' leadership were adapted into a questionnaire in the form of statements presented with a scale from 1 to 5, of which 1 means strongly

disagree and 5 means strongly agree. The answers from respondents were then calculated to determine the average to determine their performance with regard to the items studied. The closer the average is to the highest score of 5.0, the better. To enrich the discussion, we also conducted FGDs with the principal and ESD subject teachers in each school.

The data were collected from four different cities/regencies in Central Java, one of the largest and most densely populated provinces in Indonesia. These areas were represented as a standard of education in Indonesia, especially those schools implementing ESD. The study areas included Banjarnegara, Salatiga, Semarang, and Kudus. The schools, as the units of analysis in this study, that participated in this research were Green Schools, which commonly called Adiwiyata Schools. These schools received the title of caring and environmentally friendly cultured school as they applied educational, participatory, and sustainable principles set by The Ministry of Environment and Forestry. The population included the coordinator of ESD and teachers at Green Schools in which the respondents were selected using convenience sampling. In addition, the teachers involved in this study were those who had more knowledge about ESD than other teachers in general. The samples collected from four schools in the four regions in total made up 133 teachers, a representative sample number for factor analysis [33], described in the following paragraph.

Table 1 describes respondents in this study who differ in background, region, gender, age, education, marital status, and teaching experience. Respondents from Semarang were more numerous than those from other regions because there were also more students in Semarang than in other areas. Most respondents were women, Bachelor/Diploma graduates, and married. The respondents in terms of age and teaching experience were dominantly those who were 51 to 60 years old age and had >20 years of teaching experience compared to other respondent groups. With an adequate educational background, age, and teaching experience in environmentally friendly curricula, these research respondents had sufficient knowledge in the learning process and were credible to answer the questions in the questionnaire. The teachers in the research sample were the coordinators of school subjects with environmental content and have incorporated ESD content into learning, both theoretically and practically. In general, teachers of environmentally friendly subjects hold a practicum program on Saturdays in which the program did not only involve internal academia, but also parents, the surrounding community, and partners. In this study, there were no technical difficulties during the process of data collection, but in all schools, ESD was considered a new concept only heard by teachers, the coordinator and the principals of Adiwiyata Schools. Hence, the ESD concept was initially introduced, and at the same time we compared it with the Green School concept developed by the Ministry of Environment and Forestry.

Table 1. Respondents' identity.

	Items	N	%		Items	N	%
City	Banjarnegara	21	16%	Education	Bachelor/Diploma	110	83%
	Kudus	39	29%		Master/Doctor	23	17%
	Salatiga	32	24%	Marital Status	Not married	5	4%
	Semarang	41	31%		Married	110	83%
Sex	Male	43	32%	Were married	18	14%	
	Female	90	68%	≤5 years	26	20%	
Age	21–30 yo	21	16%	Teaching Experience	>5 to 10 years	13	10%
	31–40 yo	26	20%		>10 to 15 years	11	8%
	41–50 yo	21	16%		>15 to 20 years	12	9%
	51–60 yo	65	49%		>20 years	71	53%

Based on the primary data described in Table 1 above, the measurement scale of systems thinking and leadership was tested using exploratory factor analysis or EFA [34]. This was necessarily applied because the EFA is widely used to find the factor number and category. EFA was applicable for this study because we involved education as a social field using a survey in addition to an oblique rotation. The Kaiser–Meyer–Olin Test (KMO) was expected to be 0.60 and the preferable variance (TVE) was 50% as the mediocre level, but higher values were preferred [35]. The scale was then retested using confirmatory factor analysis or CFA [36]. CFA was used to confirm the measurement dimensionality. The measurement models cut off were chi-square sig level >0.05 , CMIN/DF < 2.0 , and CFI > 0.95 .

3. Results

The government of Indonesia, under the coordination of the Ministry of Environment and Forestry, developed a formal educational institution which was considered able to successfully conduct collective actions in a conscious, voluntary, networking, and sustainable manner when taking environmentally friendly actions. The aim is to create caring and environmentally friendly cultured elementary, junior high and high/vocational schools. The Ministry of Environment and Forestry acted as the initiator of the program, which provides mechanisms, indicators, and awards for the schools by involving various parties [37,38]. Unfortunately, this program has indicated that learning patterns in schools in Indonesia tend to focus more on the ability to pursue achievements (academic) or how to compete, rather than on how to live and conserve [39]. In addition, the program was not developed under the coordination of the Ministry of Education and Culture, a ministry which directly regulates education in Indonesia. This is considered one of the weaknesses of the implementation of ESD in formal education in Indonesia.

The content of ESD knowledge promoted at the schools involves cleanliness, garbage, tree planting, energy conservation, water, and the identification of potential and environmental problems, as well as innovation [18]. The information provided in the schools meets the aspects of environmental education (EE), yet it does not include ESD, which is oriented towards a balance between aspects of knowledge, skills, attitudes, and behaviors towards the natural, social, and economic environments. The value should even include an important portion of ESD [5]. Thus, teachers' systems thinking and leadership are essentially required to not only make ESD work, but also to orient education to the both natural and social environment. However, ESD teachers' capabilities related to learning orientation, leadership, building collaboration, and evaluating ESD implementation can also be reviewed because they are the most important components in the overall education system that must receive maximum attention. This figure will be in a strategic spotlight when talking about education problems as teachers are always associated with any components in the education system.

3.1. Systems Thinking

Teachers' Standard Competence is a measure of professional teaching abilities so that students can actively receive information, knowledge, experience, and new competencies to be able to shape or to change attitudes and behaviors in any situations. These required competencies including interpersonal, scientific, technological, and spiritual abilities. Teachers' scientific abilities and skills are represented in the context of systems thinking, i.e., the ability to holistically think and engage in a complex and uncertain environment using various tools and techniques. [40]

Teachers' systems thinking at environmentally friendly cultured schools in this study was mostly depicted by their ability to plan lessons and to implement them. The implementation included capabilities in developing the learning content and improving students' active learning. A carefully designed syllabus helps students to understand the concept of sustainability from local and global perspectives, while assignments and discussions make them better able to think critically, to explore deeper problems, and to find causes

and solutions to the problems [2]. The teachers' abilities in systems thinking found at the four schools in the four regions in this study are discussed.

Data from the self-administered survey in Table 2 show that the teachers' performance in planning and implementing the learning content regarding the social dimensions of sustainable development was good since the mean variable is 4.3 out of 5.0 on the scale. On the other hand, the average of the natural dimensions of sustainable development is only 3.7 out of 5.0. This fact shows that the implementation of provisions for natural dimension material still needs to be further improved.

Table 2. Average for systems thinking performance.

Measures	Perf	Measures	Perf	Measures	Perf
Planning		Implementation of Natural Environment		Implementation of Social Environment	
a. Preparation	4.8	a. Air pollution	3.8	a. Drug, Smoking	4.1
b. Alignment and updating	4.5	b. Water pollution	3.8	b. Free sex	3.8
c. Innovation content	4.1	c. Sound pollution	3.7	c. Misused of social media	4.3
d. Cleanliness content	4.4	d. Global warming	3.6	d. Interaction to Schoolfellow	4.4
e. Energy consumption content	3.2	e. Plastic waste	3.7	e. Interaction with the Elderly	4.6
f. Mutual respect content	4.5	f. Animal extinction	3.4	f. Bullying	4.4
g. Senior respect content	4.6	g. Environmental damage	3.9		
		h. Resources scarcity	3.7		
Average	4.3	Average	3.7	Average	4.3

The teachers were the best at learning preparation and planning for the provision of social content at the beginning of the semester. In contrast, the performance in planning the content of energy consumption in teaching showed the lowest score; i.e., it ranges between 3.4 and 3.9 out of 5.0 on the scale for providing natural environment content, as seen in Table 2 above. In the social environment, the indicator interaction with the elderly became the main focus of the teachers; conversely, free sex was the least important focus. This might occur because free sex is still considered a taboo conversation in the culture of Indonesian society [41], while in fact students consider their teachers as the most important source for sex education [42].

In the EFA, the constructs' indicators of planning, natural, and social environment are all significant at 0.000 levels. The reliability, KMO, and TVE are presented in the following table.

Table 3 reveals that all variables show a high level of reliability, especially the social environment. The KMOs are all > 0.7, as well as the TVEs are > 50%, as seen in the table below. However, the factors and variables made the initial model for CFA not fit. Hence, there were some adjustments made by deleting several indicators in this study.

Table 3. Factor analysis output for systems thinking.

Variable	Reliability	KMO	TVE (%)	Factors	Measures
Planning	0.692	0.73	55.7	2	7
Natural Environment	0.692	0.91	66.7	1	8
Social Environment	0.860	0.80	77.9	2	6

Table 4 shows that some measures have low standardized regression weights. This means that the variance of measures was unable to significantly explain the construct. Some measures also had high modification indices. It also describes the variance of measures that interfered with other measures. Thus, the low standardized regression weight and high modification indices measures were omitted from the measurements, i.e., preparation and energy consumptions for the planning variable, and also plastic waste, environmental damage, and resource scarcity for the natural environment variable. The final models as shown in this table show that the variables of planning and natural environment may over fit in which the CFI is 1.000. However, they are acceptable for a measurement model.

Table 4. SEM using AMOS output for systems thinking.

Variable	Deleted Measures Number and Items	Remarks	Initial Model Fit	Final Model Fit
Planning	a. Preparation	Low Standardized Regression Weight	CMIN/DF 2.319; CFI 0.904 sig at 0.000	CMIN/DF 0.335; CFI 1.000 sig at 0.854
	e. Energy consumption content	Low Standardized Regression Weight		
Natural Environment	e. Plastic waste	High modification indices	CMIN/DF 3.545; CFI 0.933 sig at 0.000	CMIN/DF 0.806; CFI 1.000 sig at 0.521
	g. Environmental damage	High modification indices		
	h. Resources scarcity	High modification indices		
Social Environment	-	-	CMIN/DF 1.426; CFI 0.992 sig at 0.180	

These results highlight the fact that the systems thinking of teachers in environmental care and environmentally friendly cultured schools, particularly regarding planning elements and updating the social and natural environmentally friendly content, innovation, cleanliness, and mutual respect, as well as senior respect, can be measured using the alignment scale. Elements of natural environment implementation can be measured by air, water, and sound pollutions, along with global warming and animal extinction. Furthermore, social environment implementation can be assessed by all hypothesized items, i.e., drugs and smoking, free sex, misuse of social media, interactions with schoolfellows, interactions with the elderly, and bullying. Preparation, with the highest score, energy consumption, with the lowest score, and plastic waste, environmental damage and resource scarcity are not relevant in the application of a measurement scale in the population studied due to the fact that the data variance of the items is not similar to other items; thus, it cannot be generalized to the population in this research.

3.2. Teachers' Leadership

Teachers' leadership (TL) is a fundamental component in the success of ESD [43–45] because teachers are change agents [14]. TL is needed primarily in the form of commitment and its implementations to provide role models and to actively participate in groups [46,47], i.e., to influence other parties by setting good examples (being role models) and also to actively contribute to various programs concerning environmental care and social activities.

There are a variety of TL measures in ESD, such as those developed by Harris [31], Katzenmeyer [32], Al-Zboon [45], and Wilhelm et al. [14]. TL measures may have an intersection and overlap with systems thinking. However, TL in this study focused on teachers' ability to provide role models through behavior or role modelling, and to contribute to the organization or activity-based ESD or peer participation. This peer participation is essential because cognitive and emotional colleague support is needed to improve the quality of ESD competencies [45] and to inspire cooperation [48].

In this study, role modelling behavior was measured by teachers' social behavior and natural concerns in daily life, such as the use of polite sentences and gestures, and behavior in using plastic and paper, and any other unfriendly products. Peer participation was measured by teachers' involvement in various activities and participation in both internal and external environmental organizations. This participation is essential because it opens opportunities for teachers to enrich their knowledge and to obtain best practices for learning [45]. The following table, Table 5, shows the teachers' performance in role modelling and peer participation.

Table 5. Average for leadership performance.

Measures	Average	Measures	Average
Role Modelling		Peer Participation	
a. Polite sentences	4.7	a. Environmental care activities	3.4
b. Polite gestures	4.6	b. Environmental organization	3.0
c. On-time	4.3	c. Fundraising	3.4
d. Appreciate opinions	4.6	d. Social organization	3.4
e. Appreciating politeness	4.6	e. Internal recommendation	3.5
f. Bring bottle	3.5	f. External recommendation	3.4
g. Use Handkerchief	3.2	g. Discussion at association	3.4
h. Use Tableware	3.2		
Average	4.3	Average	3.4

Table 5 shows that the teachers' performance in role modelling was good since the average is 4.3 out of 5.0 on the scale, while the peer participation is only 3.4 out of 5.0, as seen in the table. The teachers were best at setting an example through the use of polite sentences in the learning process. However, they lacked in terms of being role models exhibiting sustainable behavior such as in using a handkerchief (they used tissue paper instead) and tableware (they used plastic or paper for snacks or meals). The teachers' performance in peer participation particularly in environmental organizations was relatively poor. Moreover, there was still low participation of teachers in external organizations and activities.

By using EFA, it was found that the constructs of role modelling and peer participation were all significant with indicators at 0.000 levels. In addition, the reliability, KMO, and TVE are presented in Table 6.

Table 6. Factor analysis output for leadership performance.

Variable	Reliability	KMO	TVE (%)	Factors	Measures
Role Modelling	0.644	0.554	72.950	3	8
Peer Participation	0.837	0.759	71.993	2	7

Table 6 shows that the variables had moderate and high reliability levels, especially in the variable of peer participation, but the KMO of the role modelling was <0.6, even though the TVE was 72.9%. Thus, by using the factors and variables above, it can be concluded

that the initial model for CFA does not fit. Hence, there were adjustments made in this study by deleting several indicators.

Referring to Table 7, an on-time measure of the role modelling shows low standardized regression. This means the measure was not representative of the construct. Additionally, fundraising for environmental activities of peer participation had high modification indices. This means that the measures interfered with other measures; thus, the peer participation construct could not be represented. Finally, the model fit of both role modelling and peer participation was high, in which the CMIN/DF is less than 2.0, CFI is greater than 0.95, and significance is at 0.158 and 0.072.

Table 7. SEM using AMOS output for leadership performance.

Variable	Deleted Measures Number and Items	Remarks	Initial Model Fit	Final Model Fit
Role Modelling	c. On-time	Low Standardized Regression Weight	CMIN/DF 1.500; CFI 0.967 sig at 0.084	CMIN/DF 1.414; CFI 0.980 sig at 0.158
Peer Participation	c. Fundraising	High modification Indices	CMIN/DF 4.006; CFI 0.917 sig at 0.000	CMIN/DF 1.802; CFI 0.983 sig at 0.072

The results above show that the teachers' performance as role models in ESD in this study could be measured by using polite sentences and gestures, giving appreciation for students' opinions and politeness. In addition, providing role models or good examples such as using their own bottles, tableware, and handkerchiefs could inspire students to do the same. In peer participation, teachers in ESD still need to play an active role in environmental, social and organizational care activities, in addition to also actively participating in internal and external discussions and giving feedback. Meanwhile, the items on-time on role modelling and fundraising in peer participation were not relevant for measuring teachers' performance in leadership. This can be explained by the fact that both have different data variants compared to the other items studied, and punctuality is not considered a concern in Indonesian education. It is different from Indonesia's perception, which is popularly known to have a "rubber time" culture (being late or not being on time) as one of the causes of work delays [49], although it is necessary to carry out more updated studies. The existence of a school bell helps to discipline the teachers and students in terms of class attendance. Moreover, teachers' salaries in Indonesia are still much lower than their counterparts [50]. This may be the reason why teachers were not involved in fundraising activities, even though teachers in Indonesia are commonly considered to have a high social status in society [51]. In addition, fundraising in Indonesia is an activity generally related to various environmental and social activities, so it is irrelevant to use it as a separate item.

4. Discussion

As in Poland, the Indonesian public and media's respect for ESD is still low because education is still mostly oriented towards academic achievement to get into a good advanced school, while the mass media are now essentially the main source of environmental knowledge, even compared to schools and especially the teachers [52]. Education in Indonesia is still oriented towards cognitive aspects and ignores moral values, while youth problems, such as drug abuse and free sex, which are contrary to the local values, are increasing [53], despite efforts to change this pattern from cognition to behavior or from number to description. Likewise, it is difficult to change the orientation of conventional media in Indonesia without a strong political commitment because the owners of the mainstream media in Indonesia are politicians as well as business people who determine the direction of state policy [54]. Moreover, ESD has not become part of the education blueprint of Indonesian educational institutions. This means there is still no adequate institutional support for teachers in ESD, which incidentally is highly needed in the form of facilities and policy frameworks both at the national and regional levels [55]. To reduce the schools'

dependence on the government, the Ministry of Environment and Forestry has determined that one of the elements of Adiwiyata School's assessment is economic independence in program management. Thus, the schools are competing to submit proposals for corporate social responsibility (CSR) funds from the surrounding companies for the management of economic-based programs. Furthermore, teachers set aside their desires to fund variety of Adiwiyata Programs such as the Management of Plastic and Paper Waste, Integrated Livestock and Fisheries, and the Making of Batik Eco Printing [56].

The success of ESD achieved through formal education is highly related to abilities, especially the abilities of teachers and the teams in developing systems, values, futures, and strategic thinking, and collaborative competence [11–13,57]. This comprehensive thinking is based on the ability to understand complex social-ecological-technical systems concerning present and future interests [5] along with the trade-offs to produce a design of sustainability transition using data, policies, and programs, so that they will eventually be able to collaborate with other parties through interpersonal skills. Teachers' capacities are important because they affect academic performance [58]. One of the teachers' fundamental capacities is leadership, which includes distributional, instructional, and transformational leadership [16]. Leadership is defined as the ability of teachers in role modelling, encouraging active learning, problem-centered learning, and practice-oriented learning. Teachers' leadership actions influence students' behavior in addition to the roles in teaching position [59]. Teachers' are required to be knowledge translators and interpreters in ESD due to the condition of minimal institutional support. Teachers are required to have good capability for systems thinking, such as interpersonal and scientific abilities; thus, students are able to receive knowledge and experience to change their attitudes and behaviors. Teachers are also expected to show leadership as role models for students and peers, which is useful to gain social support and to extensively develop collaboration. Indonesian teachers, unfortunately, usually have a large workload in addition to teaching and administrative work. They do not have good preparation in teaching which could lead to demotivation [60,61] and burnout [45,60]. In Indonesia, particularly, the number of students in class mostly exceeds the standard, which makes the quality of learning worse and students cannot be adequately mentored on an individual basis. This makes ESD ideal for environmentally friendly education, but it is difficult to integrate it into the formal education system. Moreover, this study found that teachers' competence in systems thinking, i.e., interpersonal, scientific, technical, and spiritual abilities, need to be improved, which is fundamental for the implementation of the natural content of ESD. This problem needs specific attention and treatment because teachers' burnout, which is characterized by emotional exhaustion, depersonalization, and decreased performance, is influenced by teacher efficacy; in this case, the teacher's lack of confidence is due to insufficient of knowledge, skills, and capacities for the teaching purposes of ESD content [62].

Teachers in this study scored highly with regard to role modelling but low in peer participation, which encompasses environmental and social organizations, caring activities and fundraising. By not exhibiting good peer participation, Indonesian teachers in secondary schools has limited access for development. This was indicated by the imbalance of natural and social environments on the teaching contents and the low use of technology. Technology has a significant role both in formal and informal education as a facilitator in knowledge sharing [63], not only by the availability of computers in the classroom but also in content development and the use of artificial intelligence [64]. By not exhibiting good peer participation, teachers also lost the opportunity to receive cognitive and emotional support from people with similar responsibilities and challenges, while the reciprocal supports are significantly important. Peer groups are useful for information exchange, discussion, and producing solutions to problems faced by teachers individually and institutionally. In addition, peer groups open opportunities for collaboration between institutions.

Indonesian teachers had a high focus on social content, but less on the natural content. Moreover, there was no uniformity in natural environment contents i.e., plastic waste, environmental damage, and scarcity resources were not an important concern for them.

This showed that the concept of Adiwiyata Schools or Green Schools, which are oriented towards the natural environment, as mentioned at Regulation of the Minister of Environment and Forestry of the Republic of Indonesia no. P.53/Menlhk/Setjen/Kum.1/9/2019 concerning the Adiwiyata Award and Regulation of the Minister of Environment of the Republic of Indonesia no. 05/2013 concerning Guidelines for the Implementation of the Green School Program, have not been successfully applied. In contrast, the strong social content may arise due to the religiosity of values and backgrounds of the teacher community [65]. This emphasizes the importance of teachers having a wider range of peer groups to enable their students to adapt the threat of social cohesion into learning as part of ESD. Environmental organizations and activities are essential to ensure teachers have sufficient discussions and interaction with regard to ESD. Courses on ESD are necessarily conducted to equip teachers because such courses or training can significantly influence teachers' confidence and self-efficacy [6] and in turn they can be more critical in developing the ESD content [2].

The concept of sustainable schools is not only limited to comprehensive knowledge related to environmental protection, but also adequate teaching tools. Therefore, teachers at environmentally friendly cultured schools need to develop a sustainable development paradigm through a school community. This community activity focuses on training to improve pedagogical content knowledge. Teachers with good pedagogical knowledge skills are able to transfer knowledge to students properly [13].

In the policy context, the government needs to produce a vertical policy framework for ESD at the regional, national and even international levels [55]. This would be essential to force government bodies to facilitate schools to encourage collaboration and partnerships; i.e., ESD should lead to profit centers rather than to cost centers. Schools must be able to ensure staff development and curriculum reviews. These are possible to implement with decentralization, where each region has more authority over their resources [66].

5. Conclusions

Formal educational programs in Indonesia still put little attention into ESD. One piece of evidence of this is shown by the fact that in Adiwiyata Schools, ESD implementation was not managed under the coordination of the Ministry of Education and Culture. This clearly confirms that education is still oriented towards economic growth rather than to sustainability. Moreover, the Green School concept only focused on the natural environment or the planet but has not comprehensively incorporated the elements of people and profit. This was caused by a lack of understanding of teachers in ESD since there were no adequate training, modules, and peer participation, while it was important to improve their insights and knowledge sharing. The measurement scale of systems thinking in this study included planning the teaching material, developing a syllabus and providing natural and social concern content, which covers natural and social dimensions. However, teachers in Indonesia were mostly still lacking in terms of teaching preparation and natural content, especially for plastic waste, environmental damage, and resource scarcity. The measurement scale for leadership showed that the teachers were good social models, but still lacked in avoiding the use of plastic and other unfriendly daily wares. They should also be actively involved in peer participation activities and organizations. The scale developed in this study could be used as a reference to assess teachers' performance in ESD with regard to systems thinking and leadership, as well as to develop approaches for improving the quality of ESD in Indonesia, especially the environmental care and cultural schools.

This research was conducted in schools which were considered to be the best in ESD practices. Thus, we developed high standard measurements that may not be applicable to common practice schools. This research combined exploratory and confirmatory methods. Hence, future studies are expected to conduct purely confirmatory studies to validate the dimensional structure of this study. It is also necessary to conduct future studies covering a wider scope of the population to create levels of ESD practices and the relevant measurements for each level. In terms of teachers' competence, a more in-depth future

study is required to map the needs of teachers in developing their skills and abilities through various learning platforms such as modules, training, and instructors, also peer groups. However, this study still only focused on the development of the planet dimensional scale and people of the TBL and it has covered neither the economical dimension nor the benefits of ESD. In addition, the self-assessment nature of this study, using surveys, also potentially caused bias. Thus, it is necessary to conduct a further study to observe data triangulation as well as to measure the profit content of the TBL developed in the scale.

Author Contributions: B.P. was the research leader who conceptualized the research area, the theoretical framework, and supervised and was responsible for the research progress and output. S.P.H. was the research member who helped the conceptualization and developed the research network. I.A. and N.R.H. were the field coordinators who were responsible for the data collection. B.P. wrote the article; S.P.H. added some details to the article; I.S.Z. was involved in the review and revision of the article. All authors have read and agreed to the published version of the manuscript.

Funding: We would like to thank to the Indonesian Directorate General of Research and Development, Ministry of Research and Technology, National Research and Innovation Agency for the research funding no. 101-257/UN7.P4.2/PP/2019 and 257-101/UN7.6.1/PP/2020 and Social and Political Sciences Faculty of Universitas Diponegoro for the research publication funding.

Data Availability Statement: The authors do not publicly share the data; however, any relevant parties can contact the authors if they have any inquiries.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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