Systems Thinking and Leadership of Teachers in ESD

Subjects: Education & Educational Research

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Systems thinking in education for sustainable development (ESD) is defined as the ability of teachers to comprehend and solve problems thoroughly by using components and interconnecting those involved in the system. 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 in ESD.

education for sustainable development | systems thinking | leadership | scale development

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][2][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 to 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 an 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 al multi-parties on the micro-level (individual/student), meso level (school, education, training), and macro-level (government). The fourth SDG (sustainable development goal) indirectly targets the 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 as interpreters

of knowledge [3]. The capacity required by the teachers in the context of sustainable development include systems thinking, values thinking, futures thinking (anticipatory), strategic thinking (action-oriented), and collaborative (or interpersonal) thinking [11][12][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 CO_2, 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].

2. 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 situation. These required competencies include 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. [22]

3. Teachers' Leadership

Teachers' leadership (TL) is a fundamental component in the success of ESD [23][24][25] 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 [26][27], 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 [28], Katzenmeyer [29], Al-Zboon [25], and Wilhelm et al. [14]. TL measures may have an intersection and overlap with systems thinking. However, TL in this entry focused on teachers' ability to provide role models through behavior or role modeling, 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 [25] and to inspire cooperation [30].

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