Promoting Environmental Awareness and Factors Affecting the Success of EESD Schools in Thailand for Sustainable Development

Polpipat Wattanasettanukul[a]* Sirinthorn Sinjindawong[b] & Chaiwichit Chaenchana[c]

[a] *Supervision Monitoring and Evaluation for Educational Provision Group, The Secondary Educational Service Area Office Bangkok 2, Bangkok 10310 Thailand*

[b] *Teaching and Learning Support and Development Center, Sripatum University, Bangkok 10900 Thailand*

[c] *Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, Bangkok 10800 Thailand*

Article info

Abstract

This study investigates the role of Environmental Education for Sustainable Development (EESD) in promoting environmental awareness and advancing sustainable development within Thai educational institutions. Using a qualitative approach, data were collected through in-depth interviews with seven school administrators, supported by document analysis and a synthesis of relevant literature. The study provides a comprehensive analysis of the factors contributing to the success of EESD schools in Thailand. The article is organized into five sections: the Introduction emphasizes the importance of education in addressing sustainability challenges; the Environmental Education for Sustainable Development section establishes the theoretical and conceptual foundations of EESD; the EESD Schools section traces the global and national evolution of EESD implementation; the Factors Affecting the Success of EESD Schools identifies four key drivers of effectiveness: (1) Clear Vision to Action, highlighting visionary leadership; (2) Essential Mechanisms for Driving Educational Excellence, underscoring the role of experiential and participatory teaching; (3) Combined Efforts and Shared Resources, reflecting collaborative and efficient school management; and (4) Environmental Awareness in the Hearts of Youth, demonstrating the impact of EESD on student behavior and values. The findings reveal that EESD significantly fosters environmental consciousness and sustainable behaviors among students. Successful implementation relies on strategic leadership, integrated pedagogical approaches, collaborative resource management, and active community involvement. The Implications and Future Research section offers policy recommendations for strengthening the Whole School Approach and enhancing school-community collaboration, while also calling for future studies to assess the long-term impacts of EESD programs. This research highlights the transformative power of education in cultivating environmental stewardship and underscores the pivotal role of schools as agents of sustainable development in Thailand.

* Corresponding Author
email: polpipat97@gmail.com

Introduction

The fifth principle of Thailand's 20-Year National Strategy (2018–2037) emphasizes the imperative of fostering national development grounded in an environmentally sustainable quality of life. Central to this vision is the aspiration to transition towards a green economy. This involves the protection and expansion of green spaces, conservation and restoration of biodiversity, rehabilitation of water sources, promotion of sustainable production and consumption, reduction of greenhouse gas emissions, and mitigation of climate change impacts (National Economic and Social Development Council, 2018).

An integral component of this strategy is the advancement of energy security and the promotion of energy efficiency. These environmental objectives are closely aligned with the National Education Plan (2017–2036), which seeks to instill environmentally conscious behaviors in educators, education personnel, and students at all levels. The plan advocates for the integration of eco-friendly practices and principles into educational curricula and activities, thereby nurturing a culture of environmental stewardship (Office of the Education Council, 2017).

Despite these forward-looking policy frameworks, the goals articulated in both the 20-Year National Strategy and the National Education Plan remain challenging to realize. Numerous indicators suggest that environmentally responsible behaviors have yet to become widespread among the Thai population. For example, illegal logging and the persistent issue of forest fires continue to pose serious threats to Thailand's forest resources. According to the Department of Forestry, the country's forest area declined from approximately 102.38 million rai in 2019 to 102.14 million rai in 2020—representing about 31.6% of the total land area (Poungparn et al., 2020).

Moreover, the quality of natural water resources, such as the Chao Phraya and Tha Chin rivers, has deteriorated significantly due to increasing pollution. Major reservoirs, including the Bhumibol and Sirikit dams, have also experienced declining water quality. These environmental concerns stem primarily from rapid urbanization, which has resulted in over 8 million cubic meters of domestic and community wastewater being generated daily. Industrial expansion, factory discharges, and the illegal release of wastewater into natural water bodies have further exacerbated the problem (Kladsomboon et al., 2020).

Air pollution, particularly the prevalence of fine particulate matter (PM2.5), has also reached critical levels in numerous provinces—including Bangkok, Chiang Mai, Lampang, Phitsanulok, Khon Kaen, Nakhon Ratchasima, and Samut Prakan—where annual average concentrations have exceeded the safety threshold of 25 micrograms per cubic meter since 2021. Contributing factors include the open burning of plastic and hazardous waste, agricultural residue burning, and emissions from vehicular traffic. These pollutants pose severe health risks, penetrating deep into the respiratory system and bloodstream and contributing to respiratory and cardiovascular diseases, skin conditions, and cancer (ChooChuay et al., 2020; Amnuaylojaroen, Parasin, & Limsakul, 2022; Sirithian & Thanatrakolsri, 2022).

The current situation and the aforementioned problems have led many stakeholders, including both the government and the private sector, to make efforts to address these issues. The Ministry of Education, in collaboration with the Department of Environmental Quality Promotion, has established the Environmental Education for Sustainable Development School (EESD schools) project. This project aims to develop schools through the Whole School Approach and has five main objectives:

1. To instill environmental consciousness in youth, schools must become places where students are aware of the importance of conserving natural resources and the environment, understand the impacts of pollution and global warming, and become citizens who actively contribute to solving environmental problems.

2. To promote learning and integrate the curriculum on living environmentally-friendly lives across all subjects, such as sustainable agriculture, clean energy, and waste management, emphasizing both theoretical knowledge and practical applications.

3. Selected schools designated as Educational School for Sustainable Development should serve as models for other schools in creating environments conducive to environmental learning, through waste management, energy conservation, and green spaces within the school.

4. To produce a workforce comprising educational administrators, teachers, and the younger generation who are essential to the nation's development, equipped with knowledge and understanding of environmental science-related subjects such as environmental science, environmental engineering, public health, agriculture, and education and research.

5. To conduct environmental research, some schools have research centers studying various environmental issues to find sustainable solutions, including developing environmentally-friendly innovations within the school.

These efforts aim to integrate environmental education into the school system comprehensively and cultivate a new generation of environmentally-conscious citizens who will contribute to solving environmental challenges (Office of the Basic Education Commission, 2022; Wattanasettanukul et al., 2022). The success of EESD schools can be measured through various frameworks, including the assessment of students' environmental literacy, the effectiveness of sustainability projects, and changes in community practices and awareness (Berchin et al., 2018; Maurer & Bogner, 2022). Furthermore, indicators such as waste reduction, energy efficiency, and participation in local environmental initiatives provide tangible metrics to evaluate the impact of these schools (Prasetiyo et al., 2020).

In addition to addressing these challenges, it is crucial to strengthen collaboration between schools, local communities, and environmental organizations, as these collaborations can amplify the impact of environmental initiatives. Schools can serve as hubs for community-wide initiatives, such as waste reduction campaigns and reforestation projects. Policymakers and educators should prioritize integrating environmental awareness into the national curriculum and expand the Whole School Approach to more schools in Thailand to foster a culture of environmental responsibility among the youth. Additionally, continuous professional development programs for teachers and administrators should be implemented to enhance their ability to apply sustainable education practices effectively.

Future research should investigate the long-term impact of EESD schools on students' environmental behaviors and their contributions to sustainable development in their communities and workplaces. Comparative studies between urban and rural EESD schools in Thailand could provide valuable insights into context-specific challenges and tailored solutions. Furthermore, exploring the integration of emerging technologies, such as virtual reality and AI-driven platforms, could enhance environmental education and engage students more effectively. Developing robust frameworks for assessing the success of EESD schools is also essential, incorporating both quantitative indicators, such as waste reduction and renewable energy usage as well as qualitative measures, such as changes in attitudes and behaviors.

Therefore, this article, titled "Promoting Environmental Awareness and Factors Affecting the Success of EESD Schools in Thailand for Sustainable Development," aims to highlight the pathways through which environmental education can foster a culture of sustainability, empower schools to be leaders in environmental stewardship, and provide actionable recommendations for enhancing the implementation of EESD initiatives in Thailand. By understanding the success factors and challenges of EESD schools, this study seeks to encourage educators, policymakers, and stakeholders to recognize the importance of environmental education and collaborate more earnestly to achieve sustainable development goals. The findings emphasize the pivotal role of school leadership, community engagement, and innovative learning practices in advancing environmental education, ultimately contributing to the development of environmentally conscious citizens and a sustainable society.

Environmental Education for Sustainable Development Background

The origins of natural education can be traced to the early 18th century, notably through the work of Jean-Jacques Rousseau in *Emile:* or, *On Education.* Rousseau emphasized the importance of educating individuals in accordance with their natural development and fostering a harmonious relationship between humans and the environment. Several decades later, Louis Agassiz echoed Rousseau's educational philosophy, advocating for experiential learning and encouraging students to study nature directly rather than relying solely on textbooks. Together, Rousseau and Agassiz laid the ideological foundation for what would later evolve into formal approaches to natural education (Gough, 2020).

By the early 19th century, natural education had become more widespread and was often delivered through fables and moral narratives designed to instill a sense of wonder and reverence for the natural world. One of the most influential figures during this period was Anna Botsford Comstock, who led the Department of Nature Study at Cornell University. In 1911, she published *The Handbook of Nature Study,* which presented environmental knowledge in an engaging and accessible manner for students. Her work reflected the cultural values associated with the human-nature

relationship and significantly advanced the nature study movement. Comstock's efforts were supported and expanded upon by other advocates such as Liberty Hyde Bailey, who helped reform science curricula with the support of educators, scientists, and community leaders across the United States (Bailey, 2019; Comstock, 2020).

Interest in natural education resurged during the economic crisis and environmental devastation brought about by the Dust Bowl of the 1920s and 1930s. The prolonged drought, which lasted over eight years, severely impacted ecosystems and agricultural productivity in the United States and Canada. This crisis shifted the focus of natural education toward a more scientific and solution-oriented approach. Natural education during this period became a key mechanism for addressing social, economic, and ecological challenges, promoting a more pragmatic engagement with environmental issues (Hornbeck, 2020).

The environmental movement gained further momentum in the late 1960s and early 1970s, a time marked by geopolitical upheaval, including the Vietnam War and the Cold War. A seminal moment in the history of environmental awareness occurred with the publication of Rachel Carson's *Silent Spring*. Carson highlighted the environmental and health consequences of radiation and widespread chemical use in agriculture, particularly pesticides and insecticides. Her work catalyzed global environmental consciousness and significantly elevated the role of natural education. Environmental responsibility, once the domain of policymakers and scholars, began to permeate all sectors of society—consumers, voters, educators, community leaders, and businesses alike. This period also saw the founding of the National Rural Studies Association in the United Kingdom, now known as the National Association for Environmental Education, which aimed to support educators in integrating sustainability into curricula (Montrie, 2018; Bennett, 2019; Join, 2021).

In 1969, the field of environmental education gained formal academic recognition. That year, an influential article on environmental education was published in *Phi Delta Kappan,* and William B. Stapp coined the term "Environmental Education" in *The Journal of Environmental Education.* Stapp would later become the first Director of Environmental Education at UNESCO (Avazov et al. , 2019). Shortly thereafter, UNESCO recognized April 22, 1970, as the first Earth Day, underscoring the global importance of environmental education (King et., 2021). In the same year, the United

States passed the National Environmental Education Act under President Nixon, aiming to incorporate environmental education into K–12 curricula. Subsequently, in 1971, the National Association for Environmental Education—now known as the North American Association for Environmental Education—was established to promote environmental awareness, provide educational resources, and support the integration of environmental education in schools (Warju et al. , 2018).

At the international level, environmental education gained recognition during the United Nations (UN) Conference on the Human Environment held in Stockholm, Sweden in 1972. It declared environmental education as a vital tool for addressing global environmental issues. Additionally, UNESCO and the United Nations Environment Programme (UNEP) formulated three significant declarations: the Stockholm Declaration, the Belgrade Charter, and the Tbilisi Declaration, which provided guidelines for environmental education (Berchin et al., 2021).

This momentum culminated in the establishment of the United Nations Decade of Education for Sustainable Development (2005-2014) (UNDESD) in 2002. The UNDESD aimed to generate significant momentum for considering, stimulating, and positively altering global action in response to challenges. The Commission on Education and Communication (CEC) supported UNDESD's initiatives by structuring the core axis of "Education for Sustainable Development," comprising five main components: envisioning a better future, critical thinking, participatory decision-making, partnership, and systemic thinking, integrating environmental education. Since then, environmental education for sustainable development has been at the forefront of global initiatives (Scalabrino et al., 2022).

Definition

Environmental education for sustainable development refers to a systematic educational process aimed at fostering environmentally responsible citizenship. Students integrate various disciplines such as biology, chemistry, physics, environmental science, geology, atmospheric science, mathematics, and geography to understand the mechanisms of the natural environment. This is achieved through experiential learning outside the classroom, such as visits to aquariums, zoos, public parks, and science centers, to comprehend the intricacies of nature. It also involves managing one's own behavior and cultivating a positive environmental consciousness at the levels of schools,

communities, societies, countries, and internationally (Nuriddinovna & Meliyevna, 2022).

Additionally, UNESCO emphasizes that environmental education for sustainable development is crucial for maintaining the balance of society, economy, and the environment. It involves raising awareness of the rights of individuals in society, creating an economy that contributes to enhancing the social quality of life in the future (Quality of Life - QOL), eradicating poverty, minimizing inequality, and ensuring sustainable development through environmental conservation efforts (Scalabrino et al., 2022).

Thus, Environmental Education for Sustainable Development (EESD) serves as a transformative catalyst, shaping environmentally conscious citizens and fostering sustainable societies through interdisciplinary education and experiential learning. It equips individuals with the knowledge, skills, and values essential for effectively addressing environmental challenges, instilling a sense of stewardship and empowering responsible action. At its essence, EESD aims for a harmonious balance between society, economy, and the environment, fostering equitable and sustainable development by upholding individual rights, fostering a socially inclusive economy, and preserving natural resources. As underscored by UNESCO, EESD is pivotal for nurturing a generation capable of safeguarding the planet and creating a sustainable future, promoting environmental consciousness and driving positive changes across various levels of society towards a more sustainable and equitable world.

The Environmental Educational for Sustainable Development Schools (EESD schools)
Background

The Environmental Educational for Sustainable Development Schools (EESD schools) was developed in 1992 following a United Nations meeting aimed at engaging students and serving as a local environmental advocacy platform. It was officially launched in 1994 in Denmark, Germany, Greece, and the United Kingdom, with support from the European Commission. Subsequently, the Foundation for Environmental Education (FEE) became a global entity in 2001, prompting non-European countries to join the EESD initiative. South Africa was the first non-European country to participate.

By 2003, the EESD schools had gained momentum, fostering international collaboration to promote sustainable environmental education. The involvement of diverse nations underscored the importance of education in fostering sustainable development, local advocacy, and global environmental stewardship. The program's effectiveness and sustainability were evident in the widespread participation of countries worldwide, illustrating a commitment to enhancing environmental education for sustainable development and fostering a resilient, environmentally conscious society on a global scale.

The EESD schools has been identified by the United Nations Environment Programme (UNEP) as a pioneering initiative for sustainable development education. The Foundation for Environmental Education (FEE) has further developed the program by promoting participatory learning activities in schools that emphasize hands-on experiences, action-oriented approaches, and social responsibility. Each school follows a seven-step transformation process and aims to empower students to lead the process and actions at every stage. The Foundation believes that if schools can facilitate effective learning experiences that foster positive attitudes and behaviors among students and local communities, it can lead to significant improvements in environmental conditions at the school, community, national, and international levels. Ultimately, success in environmental development at all these levels can be achieved through the transformational power of education and active engagement in sustainable practices.

Currently, there are EESD schools that excel and are widely recognized globally for their outstanding achievements. These schools are awarded the prestigious Green Flag, with thousands being awarded worldwide. The success of environmental education for sustainable development has expanded from kindergarten to university level and operates in 68 countries, encompassing over 59,000 schools and institutions, benefiting more than 19,000,000 students. This represents the largest international educational network in the world, fostering sustainable practices and environmental consciousness on a global scale (Lysgaard et al., 2015).

The EESD schools in Thailand

The Ministry of Education, in collaboration with the Office of the Basic Education Commission and the Department of Environmental Quality Promotion, has been promoting the Educational School for Sustainable Development Project since 2005. This initiative has made significant strides in fostering environmental education and sustainable development in Thailand through a comprehensive Whole School Approach. Currently, over 1,121 schools at the Beginner level (Eco-School) are

participating in the program, engaging thousands of students and educators in various activities aimed at building environmental awareness and promoting sustainable practices.

EESD schools in Thailand achieve environmental education and sustainable development by implementing several key strategies. First, environmental topics are integrated into the curriculum across all subjects, emphasizing experiential and project-based learning. For instance, students engage in hands-on activities such as composting, building solar-powered models, and maintaining school gardens, which foster practical knowledge and environmental awareness. Second, schools adopt eco-friendly management practices, including waste segregation systems, energy conservation measures, and the creation of green spaces, which serve as live demonstrations for students and promote sustainability within the school community.

Third, community engagement is a core element of the program. Schools collaborate with local stakeholders, including government agencies, non-profit organizations, and businesses, to implement initiatives such as tree-planting campaigns, river clean-ups, and public awareness workshops on environmental issues. This collaboration enhances the initiatives' impact while fostering strong connections between schools and their communities. Finally, EESD schools actively promote student leadership through eco-clubs and sustainability committees, empowering students to take ownership of projects and advocate for sustainable practices within their communities.

A critical factor in the success of EESD schools in Thailand is their ability to provide learning experiences that encourage students to think critically and engage in hands-on activities using the local environment as a base. These experiences allow students to think creatively and learn in ways tailored to their individual abilities and interests. The emphasis on creative and flexible learning approaches aligns closely with the principles of environmental education and sustainable development (Department of Environmental Quality Promotion, n.d.; and Office of the Basic Education Commission, 2021).

Since its establishment in 1992, the EESD initiative has evolved into a global movement recognized by the United Nations and the Foundation for Environmental Education (FEE). In Thailand, the program has fostered comprehensive school development since 2005, integrating local issues into education and encouraging critical thinking through participatory and hands-on experiences. This approach emphasizes individual creativity and flexibility in learning, aiming to cultivate environmentally conscious and responsible citizens, thereby promoting environmental awareness and ensuring the success of sustainable development initiatives.

Factors affecting the success of the EESD schools in Thailand

The author conducted an in-depth, semi-structured interview with seven purposively selected participants. All participants were school administrators affiliated with the Office of the Basic Education Commission, holding positions ranging upper than Director. They had a minimum of five years of experience in EESD schools and had received national-level awards related to EESD school management.

The interview focused on four key themes:

1. Clear Vision to Action: Leadership of School Administrators.

2. Essential Mechanisms for Driving Educational Excellence: Learning Management of Teacher.

3. Combined Efforts and Shared Resources: School management for EESD schools.

4. Environmental Awareness in the Hearts of Youth: the success of EESD schools in fostering sustainable development.

Through these discussions, the study aimed to gain insights into the factors influencing the success of EESD schools in Thailand, contributing to a clearer understanding of effective strategies for promoting environmental education and sustainable development within educational institutions.

Clear Vision to Action: Leadership of School Administrators comprise three factors: 1) Visionary factor, 2) Participation factor, and 3) Ethical factor.

1) Visionary factor

School administrators must envision the future success of environmental education schools for sustainable development. This requires data analysis, which can be done through informal subgroup discussions before formal meetings. Monitoring progress and evaluating the effectiveness of environmental education school operations may involve gathering information from interviews and seeking feedback from teachers, students, environmental networks, and committees.

School administrators must set goals based on the SMART criteria since they are Specific, Measurable, Achievable, Relevant, and Time-bound. Goals should

not only focus on immediate change but should also be broken down into achievable milestones to promote a positive school culture and encourage greater participation.

School administrators must translate policies into practice by defining the structure and roles of those responsible, creating clear and easily understandable action plans and operational diagrams. These plans should include both short-term and long-term strategies. For example, in the long term, the school should aim for zero waste, while in the short term, it should start with recycling activities covering all areas, composting organic waste, and reducing single-use plastic consumption.

The research by Shutaleva et al. (2020), emphasizes that school administrators need visionary leadership characterized by clear vision-setting and proactive school management. It suggests that visionary leaders must be decisive, systemically organize the organization, understand personnel, establish internal school systems, link the vision to operational practices, project activities, and develop challenging school development models. In addition, school administrators should serve as sources of inspiration and motivation, actively encourage stakeholder participation in school management, and conduct comprehensive analyses of the institution's strengths, weaknesses, opportunities, and threats (SWOT). They are expected to apply nationally endorsed strategies—including royal initiatives where relevant—to inform school governance, formulate effective operational plans, and commit to ongoing personal and professional development. Promoting teacher capacity-building, fostering collaborative and high-performing teams, utilizing robust monitoring and academic management systems, and ensuring the consistent implementation of educational policies are also essential. Furthermore, school administrators should play a pivotal role in driving innovation and managing schools in alignment with their specific contextual needs and challenges.

2) Participation factor

School administrators must provide information by establishing a committee to oversee the implementation of environmental education for sustainable development in the school. This committee drafts policies, guidelines, and conducts reviews to ensure alignment with the school's vision and mission. Additionally, it develops a database to communicate the success of initiatives to teachers and students throughout the school, fostering inspiration for new innovations within the school.

School administrators must listen to teachers' feedback to identify specific needs, such as learning materials or learning resources required for educational excursions. They should collaborate with teachers and environmental networks to develop an integrated environmental curriculum aligned with the school curriculum and local learning content frameworks. Furthermore, they must provide opportunities for students to participate in monitoring and evaluation, where students can provide truthful and prompt feedback.

School administrators must actively participate in activities such as engaging with the community and policymakers, as well as organizing workshops and seminars for students and teachers on waste management, water conservation, and energy saving.

The study by Brodie (2017) emphasizes the importance of school administrators' awareness and emphasis on team participation, development, and knowledge sharing among the team in educational management. Administrators should demonstrate volunteerism, dedication, and self-sacrifice in academic development to benefit common interests more than personal ones. Additionally, they should provide encouragement and motivation to the team by praising achievements, participating in planning, operations, and evaluating and improving educational management. This development should focus on five main components: 1) curriculum management, 2) teaching and learning management, 3) media, innovation, and educational technology development, 4) educational administration, and 5) learning resource development. Furthermore, training should be provided for teachers, students, and environmental network members. Schools should also promote sustainable environmental education activities through websites, Facebook, Twitter, or YouTube channels, actively listen to feedback, conduct surveys to assess satisfaction with operations, hold forums to discuss current and desired conditions, engage in joint planning, coordination, monitoring, and evaluate the results of sustainable environmental education activities.

3) Ethical factor

School administrators can demonstrate self-leadership in environmental matters by setting a good example. For instance, upon arriving at the school, they can delay turning on the air conditioning until 10:00 AM and promote the use of natural light by walking through classrooms, restrooms, and the cafeteria to remind students to turn off lights, fans, and faucets properly, and to correctly separate waste. Additionally,

they should continuously develop themselves by participating in practical meetings to gather in-depth information for improving or enhancing the school's environmental education initiatives for sustainable development.

School administrators can demonstrate leadership by inviting teachers to participate in meetings to discuss strategies for developing sustainable environmental education initiatives. They should support teachers in accessing relevant educational resources such as books, online documents, learning materials, and curriculum plans related to environmental education. Moreover, they should create opportunities for teachers, students, environmental networks, and other stakeholders to participate in initiating research projects or environmental activities at the school. Involving the community in various school projects can foster a sense of ownership and responsibility.

School administrators can effectively manage school affairs by establishing clubs or student organizations. They can provide guidance in planning and implementing sustainable environmental education initiatives, such as organizing campaigns like "Beautiful School by Our Hands" or implementing recycling projects like "Trash for Cash." They can also commend students who demonstrate leadership in environmental conservation, such as those who lead in lining up for the flag ceremony, organize activities and workshops focused on raising awareness and conserving the environment on World Earth Day or Environment Day. This emphasizes the importance of environmental protection. Additionally, administrators can collaborate with various universities by creating Memorandums of Understanding (MOUs), enabling the school to take students and teachers to use environmental laboratories to advance knowledge in sustainable environmental education. This collaboration facilitates the school's ability to conduct research and continuously develop sustainable environmental education initiatives.

According to the research by Taweesup et al. (2023), school administrators in the era of Disruptive Technology should adopt the principles of Buddhism, which are to govern oneself, govern others, and govern work, as the foundation for holistic organizational management. This involves applying the seven virtues of a virtuous person, including:

1. Wisdom to know the cause
2. Understanding to know the result
3. Awareness to know oneself

4. Estimate to know the approximation
5. Time to know the timing
6. Company to know the company
7. Individual to know the individual

These principles should be combined with modern school management concepts and the 4 (MCU) Model, which consists of:

1. 4M - Manage People:
   - Man (Know People)
   - Mechanism (Know How the System Works)
   - Material (Know Resource Allocation)
   - Molality (Know Cause and Effect with Morality)
2. 4C - Control Self:
   - Critical Thinking
   - Collaboration
   - Creativity
   - Communication
3. 4U - Utilize Work:
   - Utilize (Maximize Benefits)
   - Union (Internal and External Collaboration)
   - Ultimate (Achieve Ultimate Goals)
   - Ubiquitous (Utilize Technology in All Beneficial Aspects)

By incorporating these principles and models, school administrators can effectively manage school affairs in the era of Disruptive Technology while promoting sustainable development and holistic education.

Essential Mechanisms for Driving Educational Excellence: Learning Management of Teacher comprise three factors: 1) Curriculum-related factor, 2) Activity-based instructional management factor, and 3) Media-based instructional management factor.

1) Curriculum-related factor

Teachers must develop the curriculum structure to align with the school's vision and mission, such as "sustainability and conservation," "climate change and energy," and "ecosystems and biodiversity." This involves integrating environmental education into various subjects. For example, in English language classes, students may read and analyze literature related to environmental topics, supporting them to write compositions or creative works exploring environmental issues. In social studies, students may study the impact of human activities on the environment throughout history, analyze environmental policies, and their social and economic implications. In mathematics, real-life environmental data can be used to teach various concepts

such as statistics, graphs, and population growth patterns. In art classes, students may be encouraged to create artwork which reflects environmental issues or use recycled materials to promote sustainability.

Teachers should write course descriptions that specify the interdependence of environmental systems, analyze human impacts on the environment, and evaluate sustainable practices in several topics such as water resources, air pollution, and soil degradation. This includes activities such as laboratory experiments, local environmental system observations, and research projects on sustainable problem-solving.

Teachers must organize activities to develop students' community environmental projects, allocate resources for consultation, and acknowledge efforts through awards or commendations. Additionally, they should promote environmental topics in the curriculum, such as outdoor activity programs, service projects, and citizenship and leadership courses, to provide students with knowledge and understanding of the environment. This includes fostering behavior change for the environment and cultivating environmental awareness for sustainable development.

Aligned with the research of Derman and Gurbuz (2018), the development of an environmental education curriculum to enhance environmental learning management abilities encompasses ten components:

1. Rationale and Justification of the Curriculum: Providing the rationale and reasoning behind the curriculum's development.

2. Course Objectives: Clearly stating the objectives aimed to be achieved through the course.

3. Learning Outcomes: Specifying the desired learning outcomes for students.

4. Course Description: Providing a comprehensive description of the course content.

5. Credit Units: Determining the number of credit units assigned to the course.

6. Teaching Hours: Allocating the number of teaching hours required for the course.

7. Student Learning Outcomes: Describing the expected outcomes for students' learning achievements.

8. Content Structure: Outlining the structure and organization of the course content.

9. Duration: Establishing the duration or timeframe of the course.

10. Teaching and Learning Activities: Detailing the instructional activities and methods used to facilitate learning.

Moreover, in line with Anand (2023) research emphasizing the significance of environmental education curricula in developing appropriate attitudes and skills, it is imperative to have a well-planned and meticulously improved environmental education curriculum. This ensures the transformation of perception, knowledge, and attitudes toward the environment, ultimately leading to positive impacts on environmental conservation.

Therefore, the curriculum should incorporate activities that promote critical thinking, experimentation, and practical application. It should encourage student participation, collaborative learning, and presentations of individual contributions. Overall, the curriculum should foster a positive change in perception, knowledge, and attitudes toward the environment, resulting in a heightened awareness and commitment to environmental conservation.

2) Activity-based instructional management factor

Teachers' learning management processes should foster students' participation and critical thinking through a blended approach. Learning strategies should encourage inquiry-based learning and experiences, utilizing diverse teaching methods that connect with the real world and local environmental contexts. Students should engage in simulations of international climate negotiations or take on roles as stakeholders in resource management discussions.

Teachers facilitate learning opportunities for students to engage in real-world field experiences, allowing them to examine the impact of pollutants on plant growth, analyze soil quality in various locations, study water quality in nearby streams, or conduct biodiversity surveys. Students are encouraged to explore and record observations about plants, animals, and natural processes they encounter during nature walks around the school or in nearby natural areas.

Teachers assess and evaluate student learning using diverse methods such as tests, projects, portfolio presentations, and performance assessments. They evaluate understanding of environmental concepts and application of knowledge in real-life situations. Students are expected to provide creative suggestions for improvement or sustainable development of the environment as part of their assessment.

Aligned with the research by Al Mamun et al. (2020), teachers may employ a problem-based learning approach to cultivate students' environmental citizenship for sustainable development. The process consists of six steps:

1. Problem Identification: Teachers create various scenarios to stimulate students' interest and curiosity, prompting them to ask questions and identify problems from the activities.

2. Understanding the Problem: Students collaborate to analyze the causes of the problem and share their opinions regarding the issue.

3. Investigating and Researching: Teachers question students about potential solutions to the problem. Each group seeks additional information through self-directed learning from various sources and research activities.

4. Synthesizing Knowledge: Students exchange information gathered from their research and collectively discuss and synthesize the findings from collaborative activities.

5. Summarizing and Evaluating Responses: Each group summarizes their work and collaboratively assesses their group's performance using diverse measurement and evaluation methods.

6. Presentation and Evaluation of Work: Students present their findings and exchange additional knowledge with other groups through knowledge-sharing activities.

This process fosters a collaborative learning environment where students actively engage in problem-solving, critical thinking, and knowledge exchange, ultimately promoting sustainable environmental practices.

3) Media-based instructional management factor

Teachers can utilize various teaching aids, including printed materials, technology-based media, or other resources, to facilitate their environmental education efforts for sustainable development. School administrators can encourage teachers to procure environmental education textbooks, science journals, and research documents presenting the latest discoveries and research in environmental science and related fields. Additionally, reports, brochures, and learning materials from environmental organizations and government publications provide in-depth information about current environmental challenges.

Furthermore, promoting the development of learning materials in the form of video clips, documentaries, specialized equipment, and learning resources specifically designed for environmental education can enhance the learning experience. Providing nature study guides and environmental education manuals can also enrich the learning process.

Teachers utilize educational platforms and online modules focused on environmental education across various institutions. They leverage websites and online resources dedicated to environmental education, which often include articles, videos, infographics, data visualization, interactive games, and simulations.

Aligned with the research of Agus and Ali (2022), teachers utilize learning media to facilitate environmental education in the following ways:

1. Simulation and Virtual Field Trips: Employing interactive simulations and virtual field trips to allow students to explore ecosystems, wildlife, and environmental phenomena in simulated or virtual environments. This provides a more immersive experience than traditional classroom settings and fosters deeper connections to environmental concepts.

2. Educational Videos and Documentaries: Integrating videos and documentaries that present environmental issues in the real world, solutions, and success stories. This stimulates discussion and critical thinking in the classroom about the presented content.

3. Online Databases and Resources: Utilizing online databases and resources to access the latest information on environmental topics. Encouraging students to explore reputable websites, databases, and scientific journals helps them gather information and become aware of current environmental issues.

4. Interactive Environmental Games: Incorporating interactive games focused on environmental education. These tools make learning more participatory and enjoyable, encouraging students to actively engage and challenge themselves to achieve environmental knowledge-related goals.

5. Virtual Webinar Seminars: Organizing virtual webinar seminars with invited experts in environmental science, conservation, or related fields. This provides students with the opportunity to interact with experts, ask questions, and gain deeper insights into the practical application of environmental education in the real world.

These approaches are in line with the findings of Marques and Xavier (2020), who advocate for the use of learning media to enhance environmental education through collaborative work, multimedia storytelling projects, strategic mapping and infographics, online simulations, and continuous communication through classroom blogs for sharing ideas and fostering ongoing dialogue among students.

Combined Efforts and Shared Resources: School management for EESD schools comprise three factors: 1) Landscape factor, 2) Environmental network factor, and 3) Budget factor.

1) Landscape factor

Creating a conducive environment in classrooms, laboratories, and staff rooms within the school can be achieved by raising awareness and promoting general management among students and faculty members. This includes ensuring cleanliness, comfort, and safety through the coordination of the school's color scheme, grade levels, or subject groups responsible for shared spaces.

School administrators must promote waste management projects that cover all areas of the school. This includes having clearly labeled trash bins and sustainable practices within the school, such as the water conservation, electricity conservation, waste reduction, recycling, and environmentally friendly procurement policies. Encouragement should be given to create green spaces within the school premises, such as pocket gardens, rooftop gardens, or shaded tree areas, to promote biodiversity, improve air quality, and provide spaces for relaxation and learning about nature and the environment.

School administrators may invite consultants to provide advice and participate in evaluating the effectiveness and outcomes of resource utilization, waste management, and energy consumption. This helps identify areas for improvement and development in environmental education efforts for sustainable development. Rewards may be given to departments, grade levels, or subject groups that have successfully maintained cleanliness, pleasantness, and safety in classrooms, laboratories, and staff rooms within the school premises. This encouragement fosters participation and creates strong motivation to maintain the school's good landscape.

Aligned with the research of El-Batri et al. (2019), continuous improvement and development of the landscape create a pleasant environment with spaces for various outdoor activities. These spaces, such as relaxation areas, play areas, and reading corners, can enhance the welcoming atmosphere, excitement, communication behavior, and promote the school's image and students' learning. Green spaces between buildings, water landscapes, Thai garden houses, and royal demonstration gardens can serve as venues for knowledge transmission based on the principles of sustainability and modern theories. These areas serve as educational spaces for learning about environmental science and relaxation areas for students. Additionally, landscape elements related to amenities and decorative equipment, such as bright lighting, decorative items, and shading

devices, are crucial as they are related to the safety of the area, enhance the school's atmosphere, and contribute to a positive perception of the space.

2) Environmental network factor

Groups or teams within the school can promote knowledge exchange among administrative staff or various learning groups within the school through regular meetings, seminars, or workshops. Additionally, they can encourage students to participate in clubs, associations, or interest groups to engage in extracurricular activities, meetings, and competitions to foster networking and collaboration among students. Moreover, they can establish communication channels within the school, such as electronic newsletters or internet platforms, to share information, announcements, and various opportunities within the school, stimulating participation and discussions on environmental education for sustainable development within the school.

School administrators must provide opportunities for external groups or organizations, such as NGOs, experts, alumni, local communities, non-profit organizations, and government agencies working on environmental issues, to participate in discussions about emerging trends and practices. They can invite speakers and experts from academia, industry, and non-profit sectors to share knowledge and experiences with the school through lectures, seminars, or workshops where these experts can interact with students and teachers. Additionally, they can utilize online platforms such as social media and professional networking websites to connect with individuals and organizations working on environmental education and sustainable development.

In line with the research of Novitasari et al. (2019), schools should establish both internal and external environmental networks. The project objectives and goals of initiating green school programs should be clearly outlined. This involves identifying key stakeholders within the community and the school, reaching out to local and national environmental organizations focused on education and sustainability for in-depth information sharing, resource allocation, and potential funding opportunities. Collaboration with local businesses, community groups, and government agencies committed to sustainability is essential. Creating social media profiles for green school projects using platforms like Facebook, Twitter, and Instagram helps individuals and organizations working on environmental sustainability. Organizing relevant activities and workshops related to environmental issues and sustainable practices fosters

awareness within the school community and attracts supporters. Consulting with experts in education for sustainability and the environment, including environmental scientists, educators, and specialists, can provide guidance on effective green practices. Developing educational programs related to the local community may involve organizing practical workshops, seminars, and public relations campaigns to raise awareness about the importance of environmental sustainability. Regular evaluation of the environmental impact of green school projects is necessary, with recognition, acceptance, and positive support from the community to encourage continued efforts towards sustainability.

　　　3) Budget factor

　　　Planning can be done by prioritizing the sequence of environmental activities that align specifically with the mission and vision of the school's environmental education for sustainable development. Consulting with all relevant parties to gather information about the resource needs for implementing environmental education initiatives for sustainable development is essential. Adjusting the budget according to the necessity by allocating funds to areas with potential for further development.

　　　Most schools allocate 10% of their annual budget for environmental education projects for sustainable development through the general administration group. They conduct practical training to develop environmental expertise for teachers, initiate energy conservation efforts, and allocate funds to support innovative ideas, such as expanding green music garden projects or introducing renewable energy initiatives. Some schools invest in energy-saving technologies, recycling bins, composting systems, renewable energy installations, or replacing light bulbs with energy-efficient LEDs. Additionally, they oversee procurement to acquire environmentally friendly materials like recycled paper.

　　　Financial reporting checks occur periodically to ensure that budget allocations are used efficiently and effectively. For example, upgrading infrastructure to achieve the sustainable development goals of environmental education in schools requires regular monitoring. The impact of such projects must significantly benefit the students.

　　　The research by Prasetiyo et al. (2020) emphasizes the importance of environmental care in schools through the Adiwiyata Green School project in Indonesia. It suggests evaluating the current environmental impact of the school, identifying areas for sustainable

practices, setting clear sustainability goals, and determining feasible funding sources. Developing budgets and allocating funds for various sustainability aspects, such as energy-efficient infrastructure, waste reduction projects, environmental education materials, and green activities, is crucial. Prioritizing sustainability aspects based on their impact and feasibility, focusing on high-impact projects aligned with the school's overall goals, and involving key stakeholders in budgeting processes are recommended. Additionally, assessing the long-term benefits of sustainable investments, investing in energy-saving technologies and practices to reduce utility costs, allocating funds for waste reduction projects like recycling and composting, promoting a culture of waste reduction within the school, and regularly monitoring progress and evaluating impacts are essential. Flexibility in budget adjustments based on feedback, changing priorities, and new opportunities is important. Clear communication of the financial impact of projects to stakeholders, emphasizing cost savings, return on investment, and overall positive benefits to the school's mission and values, is also highlighted.

Environmental Awareness in the Hearts of Youth: the success of EESD schools in fostering sustainable development comprise three factors: 1) Sustainable environmental citizenship factor of students, 2) Sustainable natural resource management factor, and 3) Green innovation factor.

　　　1) Sustainable environmental citizenship factor of students

　　　Students have a comprehensive understanding of environmental issues, including the interconnected systems of the Earth, such as ecosystems, climate, and natural resources. They grasp the sources and impacts of greenhouse gases and various types of pollutants on the environment and human health. They comprehend waste management strategies, recycling, and waste reduction practices.

　　　Moreover, they understand human activities that contribute to rising temperatures and changing weather patterns. They possess strategies for environmental conservation and sustainable development, aiming to balance economic growth, social equity, and environmental protection. They are knowledgeable about environmental policies, laws, and regulations both domestically and internationally.

　　　Students actively participate in changing their behaviors to benefit the environment, including waste reduction, reuse, and recycling. For instance, they use

reusable water bottles and lunch containers, avoid single-use plastics, and support environmentally friendly learning equipment. They consume responsibly and prioritize sustainability by using water efficiently, turning off lights and electronic devices when not in use, and opting for sustainable transportation methods such as walking, biking, or using public transportation to reduce carbon emissions.

Students also develop environmental awareness for sustainable development and support others to do the same by expressing concern for the environment through art exhibitions, creating artworks, photographs, or films focusing on environmental issues or showcasing the beauty of nature to inspire others. They demonstrate responsibility for the school environment by taking care of shared spaces such as classrooms, corridors, and outdoor areas. They share knowledge and understanding of environmental issues with peers and teachers, providing in-depth information based on their knowledge and experiences. They take on leadership roles in promoting environmental awareness and sustainability within the school and extend their concern for the environment beyond the school boundaries by participating in community service projects focused on environmental conservation. This may include volunteering for local clean-up activities, participating in community gardens, or supporting local environmental organizations.

The research findings by Althnayan et al. (2022) indicate that sustainable environmental citizenship requires knowledge, behavioral changes, and environmental consciousness, which can be demonstrated through active participation. This includes robust engagement in recycling and waste segregation projects, minimizing single-use plastics, conserving energy, promoting energy efficiency, water conservation, and advocating for sustainable transportation options. Furthermore, it involves raising awareness, sharing information, and educating others about environmental conservation, as well as actively participating in community service projects focused on environmental preservation. Supporting policies and activities that promote sustainability, endorsing environmentally friendly business practices, and engaging in political activities that prioritize environmental sustainability are also essential. In summary, the research underscores the importance of active participation and environmentally friendly actions to foster a sustainable and resilient society.

2) Sustainable natural resource management factor

Waste management can be achieved by promoting recycling projects within the school premises, providing clearly labeled recycling bins for different types of waste such as paper, plastic, and glass. Additionally, composting bins can be set up for organic waste generated within the school. Local experts or external speakers can be invited to educate both teachers and students. Moreover, promoting waste reduction practices such as using reusable water bottles, lunch containers, and cloth bags can also help minimize waste generation.

Water conservation can be achieved by implementing measures such as tightening water taps to prevent leaks, providing channels for immediate reporting of pipe leaks, and supporting the use of water-saving equipment in schools, such as low-flow faucets, dual-flush toilets, and sensor-operated taps in bathrooms. Emphasizing the importance of responsible water usage is crucial. Exploring the feasibility of implementing rainwater harvesting systems in schools to collect rainwater for watering plants, cleaning, or flushing toilets is also recommended.

Electricity conservation can be achieved through collaboration in monitoring electricity usage to identify areas of energy loss in the school. Teachers and students can participate in proposing solutions to energy-saving issues. Efficient lighting usage can be encouraged by supporting the replacement of traditional bulbs with energy-saving LED bulbs throughout the school. Turning off lights when leaving rooms or using natural light whenever possible is also recommended. Additionally, promoting responsible use of electronics by turning off devices when not in use or using power-saving modes is important. Emphasizing the importance of unplugging electrical appliances when not in use can also contribute to energy conservation efforts.

Aligned with the research by Maurer and Bogner (2022), schools can integrate various activities such as incorporating the school garden into the curriculum. This can involve blending lessons on plant life cycles, composting, and organic gardening. Developing waste management programs that encompass recycling bins, composting facilities, and campaigns to raise awareness about reducing single-use plastics is crucial. Implementing green infrastructure elements such as green roofs, rainwater harvesting systems, or permeable pathways to manage rainwater and promote biodiversity diversity is

also essential. Researching and showcasing renewable energy sources such as solar, wind, or hydro energy and inviting experts to discuss the feasibility of addressing renewable energy issues in schools can further enhance sustainability efforts. Encouraging student involvement in designing sustainable modifications or renovations to school buildings, such as installing green roofs, solar panels, or energy-efficient windows, is vital. This contributes to sustainable natural resource management encompassing waste management, water conservation, and electricity conservation.

3) Green innovation factor.

Green knowledge is created in the form of concepts, guidelines, strategies, or working models, derived from monitoring environmental issues, trends, and innovative problem-solving methods through reading books, articles, and sustainability reports. It involves applying the principles of circular economy, emulating strategies and principles of nature to address problems sustainably and fostering a culture of innovation in the workplace. This is achieved through design thinking methods to tackle environmental challenges, promoting problem-solving through creativity, and regularly reviewing attitudes, practices, and daily routines to identify environmentally friendly options. Continuous improvement and iteration are emphasized, learning from both successes and failures simultaneously.

To manage an office to be green, promoting recycling throughout the school is essential. Supporting paper reduction initiatives and providing recycling points for ink cartridges, batteries, and electronic waste are crucial steps. Encouraging the use of reusable glassware, plates, and utensils in the office kitchen is also important. Clear energy conservation policies should be established, utilizing LED light bulbs, natural lighting, and programmable thermostats to efficiently control heating and cooling systems. Sustainable procurement practices must be implemented, sourcing office materials and equipment made from recycled materials. Choosing environmentally friendly office supplies and equipment, including cleaning products and paper products, should be prioritized. Promoting sustainable transportation is essential, focusing on developing sustainable alternatives to conventional fossil fuel vehicles such as electric vehicles (EVs), electric buses, and light rail systems. These initiatives contribute to reducing pollution and improving overall transportation efficiency within the school premises.

Innovations or technologies used in school environmental management for sustainable development include the adoption of renewable energy technologies such as solar energy, wind energy, and hydroelectric power in schools. Developing learning resources related to sustainable agriculture, agricultural technologies, soilless cultivation, vertical farming, and organic farming methods. Utilizing advanced water treatment technologies such as membrane filtration, reverse osmosis, and ultraviolet (UV) radiation for water purification. Additionally, schools implement water treatment systems through rainwater harvesting and water recycling to promote water conservation and reduce reliance on infrastructure. Schools have also found that digital technology, data analytics, and artificial intelligence (AI) can improve efficiency and decision-making for energy systems, water management, and waste reduction efforts.

The research findings by Abbas and Khan (2023), Sahoo et al. (2023), and Saputra (2023) indicate that the key points of green knowledge revolve around environmental conservation, the significance of conserving natural resources, biodiversity conservation, and ecosystem protection. Sustainable agriculture, organic farming, and strategies to reduce environmental impacts from agriculture are crucial. Waste reduction, recycling, and minimizing single-use plastics are important strategies. Techniques to improve energy efficiency in homes, buildings, and transportation are vital. Understanding environmentally friendly products, climate change, and conservation efforts for national parks and endangered species are essential. Green management involves energy audits, recycling initiatives, and responsible waste disposal within schools. Procuring environmentally friendly products, such as recycled paper and energy-efficient appliances, is critical. Designing or retrofitting school buildings to sustainable construction standards, using water-saving measures, promoting environmentally friendly transportation for teachers and students, and creating green spaces on school grounds are integral aspects. Involving the community, organizations, and businesses in promoting sustainability and environmental awareness through initiatives, partnerships, and exhibitions is crucial for comprehensive green management in schools.

Implications and Future Study

Policymakers and educators should prioritize integrating environmental awareness into the national curriculum by adopting the principles of the EESD

schools. Expanding the Whole School Approach to more schools in Thailand can foster a culture of environmental responsibility among youth. Additionally, continuous professional development programs for teachers and administrators should be implemented to enhance their ability to apply sustainable education practices effectively. Strengthening collaboration between schools, local communities, and environmental organizations is essential, as schools can serve as hubs for community-wide environmental initiatives, such as waste reduction campaigns and reforestation projects, to amplify their impact. Furthermore, resources should be allocated to scale successful EESD school initiatives, especially in rural and underserved areas, while long-term monitoring systems are necessary to evaluate the sustainability and broader societal impacts of these programs.

Future research should investigate the long-term impact of EESD schools on students' environmental behaviors and their contributions to sustainable development in their communities and workplaces. Comparative studies between urban and rural EESD schools in Thailand could provide valuable insights into context-specific challenges and tailored solutions. Additionally, research should explore the integration of emerging technologies, such as virtual reality and AI-driven platforms, to enhance environmental education and engage students more effectively. Furthermore, developing robust frameworks for assessing the success of EESD schools is essential, incorporating quantitative indicators like waste reduction and renewable energy usage, as well as qualitative measures such as changes in attitudes and behaviors.

Conclusion

Environmental Education for Sustainable Development (EESD) plays a pivotal role in shaping environmentally conscious individuals and fostering sustainable societies. Through interdisciplinary learning and hands-on experiences, EESD equips people with the knowledge, skills, and values necessary to address environmental challenges effectively. By promoting active engagement with nature and instilling a sense of stewardship, EESD empowers individuals to take responsible action for environmental conservation. Central to its mission is the pursuit of a balanced relationship between society, economy, and the environment, which contributes to poverty reduction, inequality alleviation, and overall societal well-being. Recognized by UNESCO, EESD is indispensable for nurturing a

generation capable of safeguarding the planet and ensuring a sustainable future. The Environmental Educational for Sustainable Development Schools (EESD schools) initiative, established in 1992 and globally acknowledged, underscores the success of participatory learning and student empowerment in driving sustainability efforts. In Thailand, the project's emphasis on comprehensive school development, local issue integration, and hands-on experiences has promoted critical thinking and nurtured environmentally conscious citizens since 2005. This approach underscores the importance of individual creativity and adaptability in learning, highlighting the project's commitment to fostering a sustainable and environmentally aware society.

The cornerstone of success for schools dedicated to Environmental Education for Sustainable Development (EESD) lies in the clear vision and proactive leadership demonstrated by school administrators. The author recognizes the importance of the critical role played by administrators in driving effective environmental education initiatives. Through strategic planning, robust stakeholder engagement, and a commitment to both short-term actions and long-term goals, administrators establish the groundwork for fostering a culture of environmental stewardship within educational institutions. This is particularly relevant in the context of promoting environmental awareness and the factors influencing the success of EESD schools in Thailand for sustainable development. By fostering collaboration, providing resources, and leading by example, administrators empower teachers, students, and the wider community to actively participate in environmental conservation efforts. This collective effort not only enriches the educational experience but also equips future generations with the skills and mindset needed to tackle environmental challenges and contribute to a more sustainable world.

School administrators also stimulate Essential Mechanisms for Driving Educational Excellence: The Learning Management of Teachers, which highlights the crucial role of educators in advancing effective environmental education initiatives within schools. Through deliberate curriculum integration, dynamic teaching methodologies, and the utilization of diverse resources, teachers foster a culture of environmental stewardship and empower students to enact positive change. By immersing students in interdisciplinary learning experiences, facilitating hands-on projects, and employing various teaching aids, educators equip the next generation with the knowledge, skills, and values

needed to address pressing environmental challenges and contribute to sustainable development. This comprehensive approach not only enhances academic learning but also fosters a profound commitment to environmental responsibility, ensuring that students are well-equipped to tackle complex environmental issues and advocate for sustainability within their communities and beyond.

Every party within the school must contribute to fostering Combined Efforts and Shared Resources: School Management for EESD schools, as emphasized by collective endeavors that underscore the pivotal role of administrators in nurturing a sustainable and environmentally conscious school environment. From instilling awareness and promoting sustainable practices to facilitating knowledge exchange and collaboration, administrators play a central role in propelling environmental education initiatives forward. By prioritizing waste management, fostering opportunities for dialogue and engagement, and ensuring effective planning and resource allocation, schools can cultivate a culture of environmental stewardship that not only enhances the learning experience but also equips students with the knowledge and skills necessary to address pressing environmental challenges. Through these concerted efforts, schools can pave the way for a more sustainable future, enriching the lives of students, faculty, and the broader community alike.

A central priority in Education for Environmentally Sustainable Development (EESD) is the cultivation of environmental awareness among youth. The success of EESD schools in advancing sustainable development is evident through collective efforts that have led to significant progress in nurturing environmentally responsible citizens and embedding sustainable practices within educational settings. This is reflected in students' active engagement with environmental issues and the implementation of practical initiatives such as effective waste management, water conservation, and energy-saving strategies. These efforts highlight schools' enduring commitment to environmental stewardship and their role in promoting sustainability values across the wider community. Moreover, the emphasis on fostering green knowledge and embracing innovative practices underscores the pivotal role of education in driving significant change towards environmental sustainability. By nurturing a culture of innovation, problem-solving, and responsible stewardship, schools are not only contributing to a more sustainable future but also

empowering students and staff to become proactive agents of change in addressing global environmental challenges. Through these collaborative efforts, schools are not only shaping a more sustainable future but also inspiring future generations to embrace the transformative potential of education in constructing a better world for all.

Promoting environmental awareness and scaling the success of EESD schools in Thailand requires strong policy implementation, teacher training, community engagement, and consistent evaluation. Enhancing collaboration between schools and local communities, and strengthening the Whole School Approach, are essential steps to amplify the impact of environmental initiatives. Future research should focus on long-term impacts, regional differences, and integrating innovative technologies to further strengthen environmental education and ensure its relevance for sustainable development. Through these concerted efforts, a generation of environmentally conscious citizens will be empowered to tackle global challenges and contribute meaningfully to a sustainable future.

References

Abbas, J., & Khan, S. M. (2023). Green knowledge management and organizational green culture: an interaction for organizational green innovation and green performance. *Journal of Knowledge Management, 27*(7), 1852-1870.

Agus, E., & Ali, K. (2022). Environmental education for high school and vocational school of Muhammadiyah City of Medan based on Islam. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal), 5*(1), 930-937.

Al Mamun, M. A., Lawrie, G., & Wright, T. (2020). Instructional design of scaffolded online learning modules for self-directed and inquiry-based learning environments. *Computers & Education, 144,* 103695.

Althnayan, S., Alarifi, A., Bajaba, S., & Alsabban, A. (2022). Linking environmental transformational leadership, environmental organizational citizenship behavior, and organizational sustainability performance: A moderated mediation model. *Sustainability, 14*(14), 8779.

Amnuaylojaroen, T., Parasin, N., & Limsakul, A. (2022). Health risk assessment of exposure near-future PM2.5 in Northern Thailand. *Air Quality, Atmosphere & Health, 15*(11), 1963-1979.

Anand, M. (2023). An Evaluative Study of the B. Ed. Curricula Operative in Universities with Specific Reference to Environmental Education. *Journal of Teacher Education and Research, 18*(1), 11-17.

Avazov, S., Saydamatov, F., & Allaberganov, X. (2019). Analyzing the concepts of "environmental education" and "environmental studies". *Bulletin of Gulistan State University, 2019*(2), 56-60.

Bailey, L. H. (2019). The Liberty Hyde Bailey Gardener's Companion. In Stempien, J. A., & Linstrom, J. (Eds.), *The Liberty Hyde Bailey Gardener's Companion.* NY: Cornell University Press.

Bennett, J. W. (2019). Ecosystems, environmentalism, resource conservation, and anthropological research. In Moran, E. F., & Lees, S. H. *The ecosystem concept in anthropology* (pp. 289-310). NY: Routledge.

Berchin, I. I., de Aguiar Dutra, A. R., & Guerra, J. B. S. O. D. A. (2021). How do higher education institutions promote sustainable development? A literature review. *Sustainable Development, 29*(6), 1204-1222.

Brodie, R. (2017). *Experiences of secondary school teachers, students, and administrators in one exemplary EcoSchool: A description of successful practices and challenges* (Master thesis). Brock University. Canada.

ChooChuay, C., Pongpiachan, S., Tipmanee, D., Suttinun, O., Deelaman, W., Wang, Q., ... & Cao, J. (2020). Impacts of PM2. 5 sources on variations in particulate chemical compounds in ambient air of Bangkok, Thailand. *Atmospheric Pollution Research, 11*(9), 1657-1667.

Comstock, A. B. (2020). The Comstocks of Cornell—The Definitive Autobiography. In Penders st. clair, K. *The Comstocks of Cornell—The Definitive Autobiography.* NY: Cornell University Press.

Department of Environmental Quality Promotion. (n.d.). *Guidelines for operating eco-schools.* Thailand: DEQP.

Derman, M., & Gurbuz, H. (2018). Environmental education in the science curriculum in different countries: Turkey, Australia, Singapore, Ireland, and Canada. *Journal of Education in Science Environment and Health, 4*(2), 129-141.

El-Batri, B., Alami, A., Zaki, M., & Nafidi, Y. (2019). Extracurricular environmental activities in Moroccan middle schools: Opportunities and challenges to promoting effective environmental education. *European Journal of Educational Research, 8*(4), 1013-1028.

Gough, A. (2020). Environmental/sustainability education in a global context: Stories of political and disciplinary resistances. In Lee, C. J. K., & Gough, N. *Transnational Education and Curriculum Studies* (pp. 99-113). London: Routledge.

Hornbeck, R. (2020). *Dust Bowl Migrants: Identifying an Archetype* (No. w27656). US: National Bureau of Economic Research.

Join, N. A. E. E. (2021). National Association for Environmental Education (UK). *Environmental Education, 127.*

King, C., Gorfinkiel, D., & Frick, M. (2021). International comparisons of school-level geoscience education–the UNESCO/IGEO expert opinion survey. *International Journal of Science Education, 43*(1), 56-78.

Kladsomboon, S., Jaiyen, C., Choprathumma, C., Tusai, T., & Apilux, A. (2020). Heavy metals contamination in soil, surface water, crops, and resident blood in Uthai District, Phra Nakhon Si Ayutthaya, Thailand. *environmental geochemistry and health, 42,* 545-561.

Lysgaard, J. G., Larsen, N., & Læssøe, J. (2015). Green flag eco-schools and the challenge of moving forward. *Responsible Living: Concepts, Education and Future Perspectives,* 135-150.

Marques, R., & Xavier, C. R. (2020). The challenges and difficulties of teachers in the insertion and practice of environmental education in the school curriculum. *International Journal on Social and Education Sciences, 2*(1), 49-56.

Maurer, M., & Bogner, F. X. (2022). Green awareness in action of saving energy in school life: Modeling environmental literacy in theory and practice experience. In *Handbook of Climate Change Mitigation and Adaptation* (pp. 3531-3556). Cham: Springer International Publishing.

Montrie, C. (2018). *The myth of silent spring.* California: University of California Press.

National Economics and Social Development Council. (2018). *National Strategy 2018 – 2037.* Thailand: NESDC.

Novitasari, D., Hidayat, S., Puruhito, D. D., Arruzi, R. K., Aliyah, F., & Mahfud, A. (2019, October). An Efforts to Maintain the Sustainability of Renewable Energy System in Rural Area through Green School Education Model. In *IOP Conference Series: Earth and Environmental Science* (Vol. 353, No. 1, p. 012051). UK: IOP Publishing.

Nuriddinovna, K. S., & Meliyevna, P. N. (2022). Characteristics of environmental education issues in Avesto. *International Journal of Discoveries and Innovations in Applied Sciences, 2*(2), 69-72.

Office of the Basic Education Commission. (2021). *School Standards Evaluation Criteria Manual Environmental education for sustainable development.* Thailand: OBEC.

Office of the Basic Education Commission. (2022). *Standard Assessment Guide of Environmental Education School for Sustainable Development.* Thailand: OBEC.

Office of the Education Council. (2017). *National Education Plan 2017 – 2036.* Thailand: ONEC.

Poungparn, S., Komiyama, A., Umnouysin, S., Rodtassana, C., Sangtiean, T., Maknual, C., ... & Kato, S. (2020). Ten-year estimation of net primary productivity in a mangrove forest under a tropical monsoon climate in eastern Thailand: Significance of the temperature environment in the dry season. *Forests, 11*(9), 987.

Prasetiyo, W. H., Ishak, N. A., Basit, A., Dewantara, J. A., Hidayat, O. T., Casmana, A. R., & Muhibbin, A. (2020). Caring for the environment in an inclusive school: The Adiwiyata Green School program in Indonesia. *Issues in Educational Research, 30*(3), 1040-1057.

Sahoo, S., Kumar, A., & Upadhyay, A. (2023). How do green knowledge management and green technology innovation impact corporate environmental performance? Understanding the role of green knowledge acquisition. *Business Strategy and the Environment, 32*(1), 551-569.

Saputra, A. R. P. (2023). The influence of green shared vision, education and training, and green recruitment, on organizational citizenship behavior for environment in elementary schools in Indonesia. *Journal of Management and Business Education.*

Scalabrino, C., Navarrete Salvador, A., & Oliva Martínez, J. M. (2022). A theoretical framework to address education for sustainability for an earlier transition to a just, low carbon and circular economy. *Environmental Education Research,* 1-27.

Promoting Environmental Awareness and Factors Affecting the Success of EESD Schools in Thailand for Sustainable Development

Wattanasettanukul et al.

Shutaleva, A., Nikonova, Z., Savchenko, I., & Martyushev, N. (2020). Environmental education for sustainable development in Russia. *Sustainability, 12*(18), 7742.

Sirithian, D., & Thanatrakolsri, P. (2022). Relationships between meteorological and particulate matter concentrations (pm2. 5 and pm10) during the haze period in urban and rural areas, northern Thailand. *Air, Soil and Water Research, 15,* 11786221221117264.

Taweesup, P., Boonpoo, S., & Chaisuk, P. (2023). TVET Management Model According to Buddhist Principle in the Disruptive Technology Era. *Panna Panithan Journal, 8*(1), 1-14.

Warju, W., Ariyanto, S., & Muzaki, L. (2018, July). Developing integrated curriculum with environmental education at vocational high school. In *International Conference on Indonesian Technical Vocational Education and Association (APTEKINDO 2018).* Indonesia.

Wattanasettanukul, P., Srisuk, C., Panthongs, W., Peerachaipawong, N. & Sinjindawong, S. (2022). Current and Desirable Conditions of Environmental Education for Sustainnable Development school (Eco-school) Under the Scondary Educational Service Area Office Bankok 2. *Journal of Environmental Management, 18*(2), 78-95.