



Energy and Water Conservations at School Setting towards Sustainable Environment

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Abstract- *There are currently a number of increasingly significant environmental concerns and threats to the future of society, and by being more energy efficient, schools can help prevent greenhouse gas emissions and improve the students' learning environment. School districts can and have used the savings from improved energy performance to help pay for building improvements and other upgrades that enhance the learning environment. The study focused on the analysis of the eco-friendly practices of STE implementers based on energy and water conservation practices. This study utilized the descriptive-survey design of research. It involved a total number of thirty-six STE teachers, eighty-four YES-O officers, and the sixty SSG officers among STE implementers. The instrument was subjected to a reliability test. The study concluded that there was no significant variation in the assessment of the participants on energy and water conservation. Thus, the growing concern with eco-friendly issues and their impact on general awareness among stakeholders requires a functional management strategy.*

Keywords: *Eco-friendly practices, STE implementers, environmental strategies, descriptive-survey design, Zambales*

INTRODUCTION

Energy and water are inextricably linked (Tellinghuisen, 2009), and when talking to schools about energy efficiency, it is important to recognize that they have more pressing needs, like the health of the students, test scores, and a significant lack of resources. In fact, speaking of "healthy, high-performance schools" is a good way to package the energy efficiency message. Showing how energy improvements can help free up resources by spending less on utility bills provides schools with a greater incentive to become more energy efficient (ENERGY STAR, 1998). Studies have found that a better physical environment that includes superior energy performance contributes to increased learning and productivity.

This, in turn, affects performance and achievement. By establishing the facilities management practices necessary

to improve energy performance and by properly monitoring and maintaining systems as part of an energy management program, schools are better prepared to improve the environmental management system. Working with schools at the district level, rather than the individual school level, is often a more effective path to follow. Also, studying energy and water conservation practices could help improve the energy efficiency of the school that serves as a key learning tool for students in terms of science, math, the environment, and social and fiscal responsibility (Bernardo, 2018; Jasper, Le, & Bartram, 2014; Nouri, Stokvis, Galindo, Blatchford, & Hoekstra, 2019; Schiller, 2019). On the other hand, the correlation between increased wealth and the increased energy consumption is very strong as well (Stanchev, Katsou, Pons, Vlasopoulos, Spencer, & Krzy, 2017), and there is a need for school's stakeholders to conserve water and energy in their day-to-day operation and function. However, unlike traditional energy, the uncertainties affecting renewable energy investment is extremely complex (Liu, Zhang, Zhao, & Liu, 2019). Thus, Lai, Li, Yang, Lai, and Li (2019) emphasized that we have to pay more attention to the quality of the school's environment, its running time, and the problems of the school energy consumption. The authors further analyzed that from the perspective of energy conservation, the heating energy consumption and electrical energy consumption are the main directions that should be concerned about. It means the energy consumption intensity of school buildings is relatively smaller, but the total energy consumption is large. They further recommended that operating time, and facilities and equipment operation plan shall be formulated to effectively achieve the purpose of energy conservation. At the same time, it is also necessary to reform and strengthen the energy management strategy and operation according to the characteristics of the schools.

These conservation practices are contributory to a more complicated global environmental problem, in which global energy demand has risen sharply over the years with developing countries (Uddin, Rahman, Mofijur, Taweekun, Techato, & Rasul, 2019).

On the other hand, Tellinghuisen (2009), mentioned that water conservation offers many benefits – among those, but seldom recognized, are the potential energy savings and avoided greenhouse gas emissions. Indeed, water conservation represents “low hanging fruit” in terms of both energy conservation and greenhouse gas savings. Equally important, water conservation measures that save hot water can save customers money on gas and electric bills, and the researcher recommended to include water conservation measures in schools. Furthermore, a study shows that energy and water are major non-staff costs in schools and a major part of schools’ environmental impact. Some schools will have greater scope for savings than others but, overall, more than 20% of energy is wasted, and simple good housekeeping can reduce fuel bills by 10% (Environment Agency, 2019). Thus, awareness of water resources management, which is an expression of the school’s stakeholders’ behavior as receive, response, valuing, and organization. Water resources are important for everyone in the world and the recent water resources are risky (Seehamat, Sanrattana, & Tungkasamit, 2016). The development of awareness of water resources management for grade 6 students is very important to solve immediately. The authors further emphasized that the developing awareness of water resources management for students in school is a learning process of the affective domain to cultivate for life-long education. Thus, budget support to encourage schools to develop resources for the implementation of environmental education must be done to prepare students to become a more responsible citizen.

Nowadays, lots of school buildings are designed according to the basis of sustainability. However, a large portion of the building stock was built before the introduction of sustainability basis. These buildings, which were designed according to the traditional approaches, are the primary consumers of energy and resources. Although energy efficient new construction applications represent a significant step for the sustainability, existing buildings must be subjected to a process of retrofit to create the intended ecological impact (Basarir, Diri, & Diri, 2019). According to the researchers, the building envelope is the most effective predictor of the energy which is used for heating, cooling, lighting, and ventilation of the buildings. Because of being in direct interaction with the external environment conditions, the building envelope is defined as the interface of energy loses. For reducing the energy use in buildings, the energy requirements of buildings must be minimized, the efficiency of energy use must be increased and systems must be set up which support the use of sustainable energy sources. They added that energy efficiency in buildings is a serious problem for an important part of the energy is spent in buildings in order

to ensure the comfort requirements. Tearing down all the old inefficient buildings and replacing them with new high-performance ones is not affordable or practical.

Such a perspective is responsive towards addressing the need to integrate Environmental Education (EE) in the school curricula. Moreover, conserving energy as a practice must be uppermost in the minds of all stakeholders. Methods for conserving energy should not only be practiced but must be re-evaluated from time to time to make sure the practice is in step with the demands and use of facilities as well as changes in technology that occur (Erichsen, 2008). Thus, the importance of EE is recognized and emphasized as one of the most effective ways, if not the only way, to meet the complicated problems of the environment (Bueno, Rojas, Gutierrez, & Mallari, 2019).

The present study collects top tips and practical ways for schools to become more sustainable, should they choose to, while at the same time saving money. Sustainable development means meeting the needs of all people now – including protecting the natural habitats that are essential to our survival – without compromising the ability of future generations to meet their own needs. Sustainable development is highly needed to protect the environment for future generations, make our economy more environmentally sustainable, and improve our quality of life and wellbeing. It is one of the responsibilities of the schools to prepare young people for the future. Such an approach is based on the belief that schools perform better when they take responsibility for their own improvement that should be reflected in their ethos, day-to-day operations and through education for sustainable development.

Thus, the present study addresses such specific environmental concerns on energy and water conservation practices.

METHODOLOGY

This study utilized the descriptive-survey design of research. Bueno (2016) defined descriptive-survey as a design to describe the nature of a situation, as it exists at the time of the study and to explore the cause of particular phenomena. Descriptive research seeks awareness with the subject, portrays selected distinctiveness of the subject accurately and provides the necessary background for the formulation of a more precise problem, for a subsequent more specific study and for the development of hypotheses. It is the most common means of obtaining information with the use of questionnaires, personal interviews with the aid of the study guide or interview schedule and observation. The researcher believed that this method is the most appropriate method to use because the study was made

to describe the eco-friendly practices STE implementers in the Division of Zambales. The study involved a total number of thirty-six (36) STE teachers, eighty-four (84) YES-O officers, and the sixty (60) SSG officers among STE implementers in the Division of Zambales. The researcher used an adopted survey-checklist from Vergara (2007). The instrument covered the main item in the study on the eco-friendly practices of STE implementers in terms of energy and water conservation. The adopted survey-checklist was tried to school heads, Science teachers, selected students and parents from selected national high schools in the division for face and construct validity only. The instrument was subjected to a reliability test. The alpha coefficients were .81 (energy conservation), and .79 (water conservation). An alpha coefficient of 0.70 or higher indicates acceptable levels of internal reliability, which means that all the items in the same category measure the same attribute. The data were statistically analyzed using Mean, and One-way Analysis of Variance (ANOVA) at .05 level of confidence.

RESULTS and DISCUSSION

Energy Conservation Practices of STE Implementers. The eco-friendly practices in terms of energy conservation are reflected in Table 1. As shown, the STE teachers and SSG officers agree that turning off the lights when not in unoccupied rooms, taking advantage of the natural lights, and turning off appliances during non-use hours are the observable eco- friendly

practices among the schools. However, the YES-O officers oftentimes observed these practices. Moreover, the YES-O officers oftentimes observed the practices such as replacing damaged doors or windows to reduce the need for cooling in the building and sometimes observed cleaning lights and fixtures regularly to keep light output high. The overall computed means are 4.47 (always); 4.40 (oftentimes), and 3.28 (oftentimes), for the STE teachers; SSG officers; and YES-O officers, respectively. Since there are slight differences in the observations of the research participants, the following are some suggestions on how to conserve energy in school: (1) Turn off lights when not in use. Lighting accounts for nearly 50% of the electric bill in most schools. This applies to energy-efficient fluorescent lights too. Form a student energy patrol to ensure lights are out when rooms are empty (check classrooms, the canteen, the auditorium; have students make signs and stickers to remind people to turn off the lights when they leave a room; have students conduct an experiment in classrooms by turning off selected banks of lights and measuring comfort at different lighting levels (Erichsen, 2008); (2) Heating and cooling-heating and cooling school buildings can be expensive, but indoor temperatures must be comfortable so teachers can concentrate on teaching and kids can concentrate on learning. Consider setting thermostats at 68 degrees for heating and 78 degrees for cooling; don't block the airflow around vents. Keep bookcases and other bulky items away from the heating and cooling units so they don't block and/or absorb the warm (or cool) air that should be coming into the room; install programmable thermostats in areas like the canteen to minimize operating hours of the heating and cooling systems during low occupancy periods; turn down heat in the hallways; keep classroom doors closed; and clean furnace filters regularly; have students determine areas of energy loss by using "draft-meters" made from plastic wrap and pencils to study where drafts are entering; have students help replace insulation and stuff energy loss "holes" with innovative measures, such as making translucent window quilts to hang in classrooms and "insulation snakes" to put at the bottom of doors and windows; work with facility staff to install permanent weather-stripping, caulking, and insulation (Iorio & Federici, 2018); (3) If school computers have power-management features, make sure controls are set so they will go into the "sleep" mode when not in active use. Students should turn off monitors that will not be used for the next class period. All computer equipment should be turned off at the end of the day and on weekends, unless your network technicians specifically instruct otherwise; form a student energy patrol to make sure monitors are off when computers are not in use and to turn computers off at the

Table 1
Energy Conservation Practices of STE Implementers

Energy Conservation	STE Teachers		SSG Officers		YES-O Officers	
	WX	DR	WX	DR	WX	DR
1. Turns off light in unoccupied rooms.	4.79	A	4.65	A	4.62	0
2. Takes advantage of the natural light or daylight.	4.70	A	4.35	A	4.31	0
3. Turns off appliances and computers during non-use hours.	4.68	A	4.54	A	4.60	0
4. Replaces damaged doors or windows to reduce the need for cooling in the building.	4.13	0	3.30	0	3.47	0
5. Cleans lights and fixtures regularly to keep light output high.	4.09	0	3.63	0	3.74	SO
Grand Mean	4.47	A	4.40	0	3.28	0

end of the day; save 50% on energy costs by using energy star computers, monitors, printers, fax machines, copiers and other equipment (US Environmental Protection Agency, 2019); and (4) Have students use a wattmeter to study how much electricity a device uses. This helps to determine which appliances are outdated and less efficient; have students conduct a survey of the number of appliances in each classroom and encourage teachers to take away unneeded ones. The findings suggest that there is a need to involve all stakeholders and the whole school to join together in conservation efforts. Schools with effective conservation programs have reported reductions of as much as 25% in utility bills, and publicize energy costs and savings. When people know how much it costs to power their school, they can see why it's worth some extra effort to avoid waste (Basarir, Diri, & Diri, 2019).

Water Conservation Practices of STE Implementers. The water conservation practices of STE implementer- schools are shown in Table 2. As exposed in the table, encouraging students to report water leaks to the maintenance staff is always observed by the STE teachers and the YES-O officers.

Table 2
Eco-friendly Practices in Terms of Water Conservation

Water Conservation	STE Teachers		SSG Officers		YES-O Officers	
	WX	DR	WX	DR	WX	DR
1. Encourages students to report water leaks to the maintenance staff.	4.58	A	3.83	0	3.94	A
2. Fixes leaks in faucets, toilets, and pipes right away.	4.34	A	3.33	SO	3.69	0
3. Collects rainwater for irrigating or other non-potable uses.	3.30	0	3.44	0	3.52	0
4. Waters plants during cooler parts of the day to minimize evaporation loss.	4.30	A	3.52	0	3.91	0
5. Presoaks utensils and dishes in ponded water instead of using a running water rinse.	3.60	0	3.33	0	3.48	0
Grand Mean	4.02	0	3.49	0	3.71	0

Fixing leaks in faucets, toilets, and pipes right away is sometimes observed by the SSG officers. Other practices such as collecting rainwater for irrigating or other non-potable use, and presoaking utensils and dishes in ponded water instead of using a running water rinse are oftentimes observed by all the respondents. The computed overall means are 4.02 (oftentimes); 3.49

(oftentimes); and 3.71 (oftentimes) for the STE teachers, SSG officers, and YES-O officers, respectively. Schools use a tremendous amount of water every day and require water for their heating and cooling systems, restrooms, drinking water faucets, rooms, canteens, laboratories, and outdoor playing fields and lawns. To reduce water use in the school, consider replacing old equipment such as dishwashers with energy-saving devices. Repair water leaks and leaky toilets. Install water aerators and automatic shut-off devices on faucets. Use low-flow shower heads and timer shut-off devices to reduce water use during showers. Install toilet dams on older models (Bernardo, 2018). Moreover, to reduce outdoor water use, maximize natural vegetative cover, and limit the amount of lawn area provided. Maintain playing fields using drought-tolerant grasses. Other outdoor water tips follow (Jasper, Le, & Bartram, 2014): Maximize the use of natural vegetation and establish smaller lawns. For portions of your lot where a lawn and landscaping are desired, ask your local nursery for tips about plants with low water demand. Consider planting more trees, shrubs, ground covers, and less grass. Shrubs and ground covers provide greenery for much of the year and usually demand less water. Use native plants in flower beds. Native plants have adapted to rainfall conditions in New England and often provide good wildlife habitat. They also provide learning opportunities for students. Cluster plants that require extra care together to minimize time and save water. Only water the lawn when necessary. If you water your lawn and flower beds, only do it once a week, if rainfall isn't sufficient. Avoid watering on windy and hot days. Water the lawn and flower beds in the morning or late in the evening to maximize the amount of water which reaches the plant roots. Use soaker hoses to water gardens and flower beds. If sprinklers are used, take care to be sure they don't water walkways and buildings. Over-watering is wasteful, encourages fungal growth and disease, and results in the growth of shallow, compacted root systems that are more susceptible to drought and foot traffic. If an automatic lawn irrigation system is used, be sure it has been properly installed, is programmed to deliver the appropriate amount and rate of water, and has rain shut-off capability. Apply mulch around shrubs and flower beds to reduce evaporation, promote plant growth and control weeds. Add compost or an organic matter to the soil as necessary, to improve soil conditions and water retention. Collect rainfall for irrigation in a screened container. Always use a broom to clean walkways, driveways, and entrances rather than hosing off these areas. Here are some of the general water saving tips (Jasper et al., 2014; Kouroupetroglou et al., 2015; Kumar, Masoodi, Poyil, & Kishore, 2018; Mcmichael, 2019; Morris, 2019; Seehamat et al., 2016;

Wei, Li, Wang, & Zhang, 2019): (1) Report all significant water losses to the local authorities. (2) Encourage school system and local government to help develop and promote a water conservation ethic among children and adults; (3) Support projects that will lead to an increased use of reclaimed wastewater for irrigation and other uses; (4) Make sure visitors understand the need for, and benefits of, water conservation; (5) Encourage friends and neighbors to be part of a water-conscious community; (6) Conserve water because it is the right thing to do; and (7) Try to do one thing each day that will result in a savings of water. Water consumption is one of the priorities of the DepEd order no. 8, series of 2006, aiming to improve the existing water facilities of the schools nationwide. Thus, water conservation is a critical element of any future water management strategy. Water conservation can help save water, save time, and save money throughout the year, not just in the summer. However, conservation efforts are only considered successful if results can be measured and results are targeted to the particular type of water user. Minimizing water use, waste, and loss over time is heavily dependent on continually evaluating and adopting new technologies and practices. Education and technical assistance programs are important to inform people in school about the impact of improved water efficiency and water conservation. Without adequate knowledge, water users lack the ability to put conservation measures and practices into place, however, motivated they may be (Kouroupetroglou et al., 2015; Kumar, Masoodi, Poyil, & Kishore, 2018; Mcmichael, 2019; Morris, 2019; Seehamat et al., 2016).

Variations on the Assessments of the Eco-friendly Practices. The variations on the assessment of the three groups of respondents regarding the eco-friendly practices among STE implementers are shown in Table 3.

Table 3
Variations of the Assessments on the Eco-friendly Practices among STE Implementers

Variables	F value	P value (.05)	Decision	Interpretation
Energy Conservation	0.8765	.44125	Accept Ho	Not Significant
Water Conservation	2.8057	.10007	Accept Ho	Not Significant

The null hypothesis is accepted for the variables, energy conservation, and water conservation. The growing concern with environmental issues and their impact on general awareness is one of the most

noticeable phenomena of the last two decades. Increase in economic activities in developing countries results in more energy and consumption demand which generally leads to environmental degradation. There is a conventional belief that such environmental degradation would resolve as soon as these countries grow economically since that would enable them to afford environmental friendly technology as well as eco-friendly strategies, regulations, and policies. However, several studies indicated that many developing countries already equipped with environmental policies, legal frameworks, and economic instruments, which are regarded as highly sophisticated by international standards and yet face the worsening of environmental conditions (US Environmental Protection Agency, 2019; & Basarir, Diri, & Diri, 2019). Major difficulties these countries confront are not only the lack of a legal and economic framework for environmental protection but also lack of participation among the general public on energy and water conservation behaviors. Some of the environmental problems which are critical at the present are fairly widely known because of the growing awareness of all levels of society, including governments, the general public, and the scientific community. The fact that people from different cultures act with a nationalistic awareness, which is seen as one of the biggest problems of globalization, is taken into consideration. It will be inevitable for us to face the fact that it would not be easy to find a solution to problems. The sensitizations and practice of environmental manner are will improve the present environmental conditions. The physical environment of a school adds a lot of value to the school. School Environment and administrator's role performance believe that the physical environment contributes either negatively or positively to the performance in the school. To expand the educational enterprise, educational planners are more interested in issues such as the number of schools, teachers, students' infrastructural facilities like classrooms and school buildings. Little attention is paid to the quality of the environmental initiatives relative to energy and water conservation (Mohod, Ingole, & Mandaogade, 2002).

Environmental Management Strategy. The school environment management plan should include the major environmental objectives and strategies for achieving these objectives through the curriculum, school resources, and school grounds. However, managing the school environment has posed great challenges over the years to the government, principals, and administrators. The challenges range from location, beautification, waste materials, landscaping, sanitation, greening, and so forth. These issues have occupied some studies by researchers

(Bueno et al., 2019; Li et al., 2019; Lefkeli, Manolas, & Ioannou, 2018; Liddiard, Kolokotroni, Mylona, Evans, & Liddiard, 2019; Liu et al., 2019; Mohod et al., 2002; Seehamat et al., 2016; Uddin et al., 2019). It is common to see school environments poorly maintained. They are often strewn with litters of papers, dusty classrooms, poor ventilation, and landscaping for sit-outs during break periods. Such environments deprive rather than stimulating learning and intellectual development. Little attention seems to be given to the quality of the learning environment, perhaps because educational planners and administrators have not been adequately informed on the environment's role in enhancing learning and intellectual development. Moreover, many educational institutions could benefit from environmental management programs to address complex school environmental issues. The environmental improvement also brings economic benefits, including reduced waste-disposal costs, a significant expense for many schools all over the country. From an environmental perspective, schools encompass many diverse activities. Even large schools with sophisticated environmental management systems (EMS) and resources have difficulty responding to changing campus needs and ensuring environmental compliance. Smaller schools face an even greater challenge because they must respond to the same environmental requirements with a much smaller organization and budget. The most effective strategies for improving the overall school environment is the conduct third-party compliance audits to identify areas of vulnerability, the establishment of programs to improve energy and water conservation and creation of a framework for a management system that can sustain and improve environmental compliance. These audits can serve as simulated inspections that help educate and create campus-wide awareness of compliance. As issues are identified, auditors can provide on-the-spot corrective actions and guidance on how to improve compliance. A strong conservation management program, including the development of written instructions and training programs, promotes compliance with regulations and ensures that wastes are managed safely (Labog, 2017).

CONCLUSIONS AND RECOMMENDATIONS

Various energy conservation practices such as turning off the lights when not in unoccupied rooms, taking advantage of the natural lights, and turning off appliances during non-use hours were identified among schools. Encouraging students to report water leaks was at all times practiced by the stakeholders while collecting rainwater for irrigating or other non-potable use, and

presoaking utensils and dishes in ponded water instead of using a running water rinse were frequently done. Thus, there was no significant variation in the assessment of the respondents on energy and water conservation practices among schools. The growing concern with eco-friendly issues and their impact on general awareness among stakeholders requires functional management strategies. Thus, schools should always observe environmental conservations. A school environmental management strategy can be calibrated like creating top management support by adopting environmental policy statement for these schools; establishing a team of employees including all teachers and students to identify and brainstorm environmental improvement and conservation ideas; identifying operations where large quantities of water and energy are used; seeking employee and student suggestions, and finding other ways to involve them in the environmental program; and building permanence into the green school program; and by making these efforts long lasting by incorporating environmental improvement into the core operations and curriculum.

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