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# ENVIRONMENTAL EDUCATION AS A TOOL FOR WATER QUALITY MANAGEMENT

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## ABSTRACT

*Anthropogenic activities have immensely contributed to the deterioration of our environment. Furthermore, developing countries such as Thailand are still struggling with the management of human population increase which is closely associated with water quality and sanitation problems. Hence, public awareness and attitudes have been identified to be highly related to the improvement of water quality globally. As a result of this, a survey was carried out on some students and teachers in Bangkok, Thailand (n=240). The findings indicated that majority of the respondents (68%) have good attitudes towards discharge of wastewater. Sex and academic qualifications of the respondents were highly not associated with the awareness level of wastewater and its treatment ( $p=.831$  and  $.162$  respectively). Moreover, the participants who previously had wastewater education had better attitude towards wastewater ( $p=.034$ ). In addition, the findings offered relationship between increased environmental knowledge and positive behavior towards the environment. Interestingly, majority of the respondents opined that environmental education is a very useful tool in solving environmental problems and hence, its teaching should be made compulsory in schools. Therefore, environmental education of wastewater and its treatment has been recommended by the researchers in schools to promote behavioral change in developing countries and consequently to improve water quality.*

**Key words:** environmental awareness, environmental education, sustainable development goal, wastewater, water quality.

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## 1. INTRODUCTION

UNDP (2019) report shows that more than 40 percent of the world's population is affected by water scarcity. This has been projected to increase due to global warming. It is observed that unplanned and rapid urbanization causes water quality and sanitation problems because as the

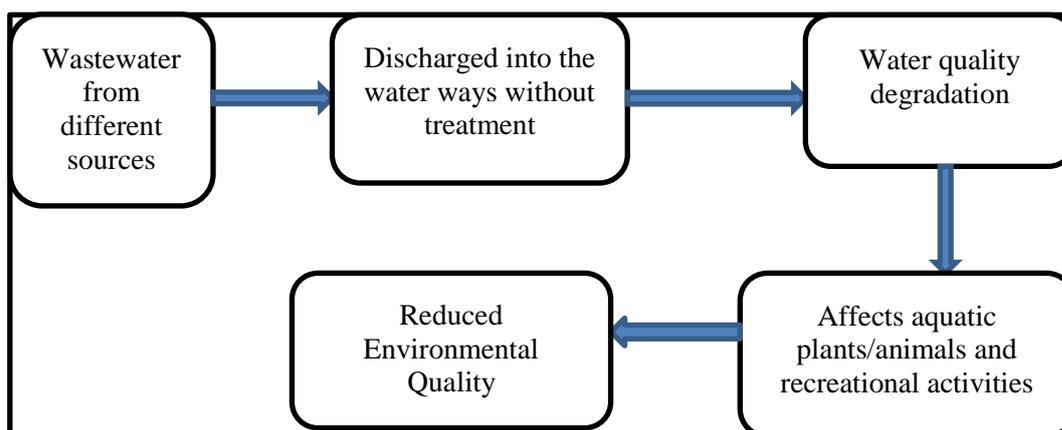
population rapidly increases, available facilities become inadequate and unfit to handle the pressure. However, in most developing countries, wastewater is discharged directly into the waterways without treatment (UN-Water, 2010) while 80 percent is inadequately treated before discharge (UNDP, 2019). According to Trivedi et al. (2012), the quality of the environment is strongly associated with the patterns of human behavior. Anthropogenic activities such as farming, manufacturing and domestic activities are the major causes of environmental pollution. In most cases, water resources are used as sinks for disposal of wastewater and other wastes. For instance, Thailand is noted to have water pollution problem which results mainly from municipal wastewater generated from daily domestic and industrial activities (Sateinpong et al., 2014).

Wastewater treatment and ecological preservation are still difficult to manage (Smith, 2009) and as a result pollution of river, stream, canal, lake, reservoir and wetland are still occurring. Globally, conventional wastewater treatment technologies have advanced in management of urban wastewater but the developing countries are still struggling with its implementation constraints. This is as a result of the high cost, lack of technological-know-how and proper monitoring system. Therefore, decentralized and natural processes which utilize locally available resources and are also cost-effective have been proposed as an alternative to the conventional methods (Kasem et al., 2014; Giri et al., 2014). This prompted the Late King Bhumibol to establish The King's Royally Initiated Laem Pak Bia Environmental Research and Development (LERD) project in the year, 1996 at Phetchaburi province, Thailand. The major objective of this project is to help in solving the environmental problems of solid waste and wastewater within the area (Kasem et al., 2014) and subsequently extend the knowledge to other areas.

Nevertheless, previous studies have identified environmental knowledge (EK) as a prerequisite to enhanced ecological behaviors. It forms the foundation for a good attitude towards the environment. Moreover, environmental education was found out to be an effective tool for increasing environmental awareness among members of the society (Otto and Pensini, 2017; Geiger et al. 2018; Hoang and Kato, 2016). In order to meet up with the sustainable development goal 6 (clean water and sanitation) which aims at ensuring availability and sustainable management of water and sanitation for all by the year 2030, a lot has to be done individually and collectively. Continuous awareness and education of the general public and students in particular are of great importance. The LERD project needs to be propagated effectively to different target groups for proper understanding of wastewater, its suitable treatment method and contribution to water quality improvement. This paper therefore aims to investigate the correlation of environmental education and attitudes of the participants towards wastewater; to determine the level of environmental awareness among the students and teachers; and to propose the best and most effective method of teaching environmental education in schools.

## 2. LITERATURE REVIEW

Globally, one of the most common environmental problems is water pollution. Since water is a basic necessity of life, its availability, affordability and accessibility remain very important to mankind and other aquatic species. In Thailand most especially, surface water and groundwater are the main water sources for drinking water production (Kruawal et al., 2005). Chao Phraya River is the largest and major water source in Thailand and it widely serves the domestic, industrial, agricultural and transportation sectors. Surprisingly though, it is also a sink for human wastes (Samorn and Candelaria, 1994). Untreated wastewater generated from homes, agricultural fields and factories are sometimes discharged without treatment into the water bodies. Fig, 1 shows the impacts of untreated wastewater on surface water quality.



**Figure 1** Impacts of untreated wastewater on the surface water (Developed by the researcher)

Lack of knowledge or simply ignorance of a particular issue remains a big problem globally. Man keeps polluting the environment either consciously or otherwise without knowing the immediate and long term consequences of their actions. For this reason, environmental education has been identified as a useful tool in eradicating some of the causes of environmental degradation, especially water pollution problem which is partly caused by untreated wastewater discharge into water ways. Environmental education can be seen as an idea, a method, a tool or a profession (Monroe, 2007); and its contents should be targeted to help in achieving a more environmental conscious, organized and sustainable society. It is therefore considered as a ceaseless process which should be inherent part of all individuals (Rodrigues, 2014) which helps them to not only develop deep understanding of environmental problems but also furnish them with required expertise in decision making (Ogueri et al., 2019).

Asares (2011) emphasizes that poverty is one of the drivers of environmental problems in undeveloped and developing countries. He therefore suggests that altering our lifestyle patterns would bring about a desirable change. Rapid population growth is highly associated with poverty rate and this subsequently leads to migration to the cities, such as Bangkok, with better job opportunities and wellbeing. In line with this argument, excessive migration is therefore identified as one of the causes of environmental degradation due to increase in carrying capacity exerted on the available resources (Taengthientam, 2000). To avert this occurrence, environmental education is needed.

In Thailand, the environmental education level is not yet stable. However, more effort needs to be given by the government and other bodies towards promotion of environmental awareness in both schools and organizations. Thathong (2010) explicitly explains that environmental issues were not directly addressed in Thai school-based curriculum but were integrated into some other subjects. On the other hand, most of the available environmental projects in schools were introduced by the teachers which show that there is lack of centralized approach towards environmental education teaching. This grossly hinders effective outcome and continuity. According to Gallagher et al. (2000), Ministry of Education of Thailand collaborated with Michigan State University on how to combat the problem of deforestation in Northern Thailand through environmental education involving Grade 6 to 8 students and the adult community members which yielded a positive outcome. Inclusion of environmental topics into Thai school curriculum was further proposed.

### **3. MATERIALS AND METHOD**

#### **3.1. Study Area**

Bangkok is located at latitude 13.7539797 and longitude 100.501442, in the northern hemisphere (GeoDatos, 2020). Interestingly, it is not only famous as the capital of Kingdom of Thailand, but also globally known for its commercial importance. Its contribution towards global trade, employment, tourism can never be over-emphasized. Thailand is the second largest economy in South East Asia with its Gross Domestic Product per Capita shooting up to 6,883.25 USD in Dec 2017. Its current GDP growth is 4.82% (CEIC, 2016). Out of the 69,757,408 people living in Thailand, 13% of them, 10,539,415 reside in the capital city, Bangkok with a population density of 136.03km<sup>2</sup> (World Population Review, 2020).

#### **3.2. Questionnaire Design and Measures**

The instrument used for the data gathering was a questionnaire. In order to assess the participants' environmental awareness level and attitude towards wastewater and its treatment, some questions were developed by the researcher adopting five-point Likert scale: strongly agree, agree, neutral, disagree, and strongly disagree. Other questions have multiple choice answers (MCAs) while some have yes, no, and neutral options. The questionnaire was designed in English Language and was created through online research software, Qualtrics. Simple and fewer but important questions were only asked to attract higher number of respondents. It used the method of self-administration which means that the participants answered the questions without any guide (Bird, 2009). It comprised of three sections; personal information, awareness and attitudes towards wastewater and its treatment and finally, the participants' awareness of environmental education and their perception towards it. The questionnaire was approved by the advisor before distribution. Ethical issues such as maintaining the anonymity of participants and use of the survey data only for research purposes were communicated to the respondents and adhered to. A clear introduction of purpose of the survey and instructions were given at the beginning of each questionnaire for guide and easy understanding. Pilot studies were further conducted on 25 people before the actual distribution of the survey. This helped to validate the proper understanding of the questions by the respondents to ensure correct answers.

#### **3.3. Data Collection and Treatment**

The survey was carried out for a total of 60 days (between January and February, 2020). Participants from Bangkok, Thailand were used as survey subjects. A total of 300 questionnaires were sent out via Qualtrics using anonymous link through social media platforms and emails. Each survey was estimated to take about 10 minutes to complete. 260 responses were returned at the end of the survey period. 10 responses have multiple missing answers and 10 were filled by respondents residing outside the study areas. These 20 responses were disqualified from further analysis bringing the number of eligible responses to 240. The responses were then coded and analyzed using IBM Statistical Package for Social Sciences (SPSS) version 22.0.

### **4. RESULTS AND DISCUSSION**

#### **4.1. Characteristics of the Respondents**

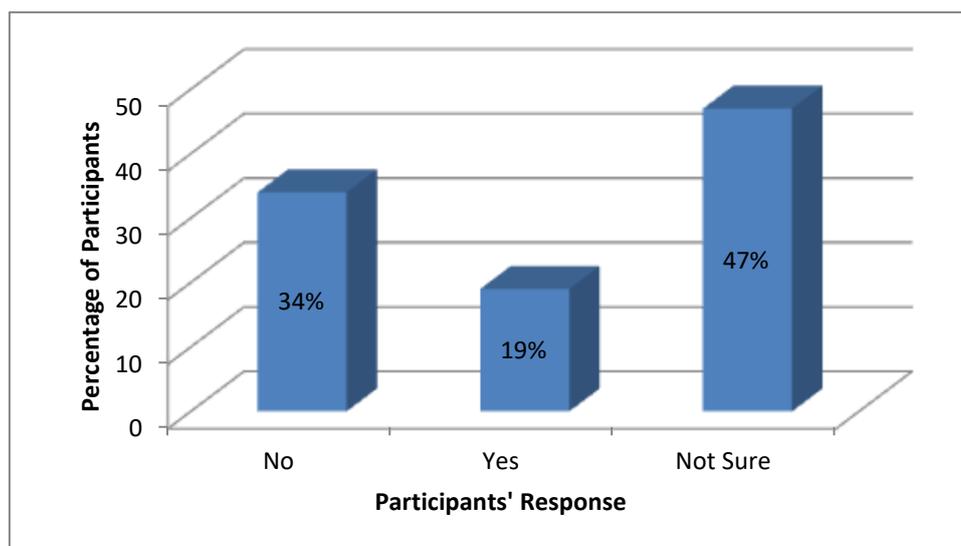
This study examined the level of awareness among students and teachers in Bangkok, Thailand towards municipal wastewater and its treatment. The role of environmental education in solving environmental problems as well as the best approach for its implementation in schools was further investigated. The total number of participants was 240 and their demographic profile is shown in Table 1.

**Table 1** Demographic profile of the respondents (Source: Field survey)

	Frequency (f)	Percentage (%)
<b>Sex</b>		
Female	96	40
Male	144	60
Total	240	100
<b>Age (years)</b>		
11-15	57	24
16-25	34	14
More than 25	149	62
Total	240	100
<b>Academic Level</b>		
Middle school	48	20
High school	43	18
First degree	72	30
Post graduate	77	32
Total	240	100
<b>Teachers</b>	100	41.7
<b>Students</b>	140	58.3
<b>Total</b>	240	100

#### 4.2. Wastewater Awareness and Attitude

In order to understand the level of awareness of the respondents towards wastewater, questions about the meaning and its sources of generation were asked. The result of the Likert scale showed a mean score of 3.83 on the understanding of wastewater by the participants. This is a good indication that they have high knowledge of wastewater. In addition, 98% of them agreed that wastewater is generated through various sources such as offices, homes, factories and farms. In line with this, 68% further reported that they do not discharge wastewater directly into the waterways while 20% recorded that they do. Meanwhile, the remaining 12% were unsure about how they discharge wastewater. Opinions of the respondents were sought to understand their views if it is good to discharge untreated wastewater directly into rivers or streams and the mean of 4.22 was recorded in favor of classifying the attitude as a bad one.



**Figure 2** Awareness of the respondents on wastewater treatment within their area of residence (Source: Field survey)

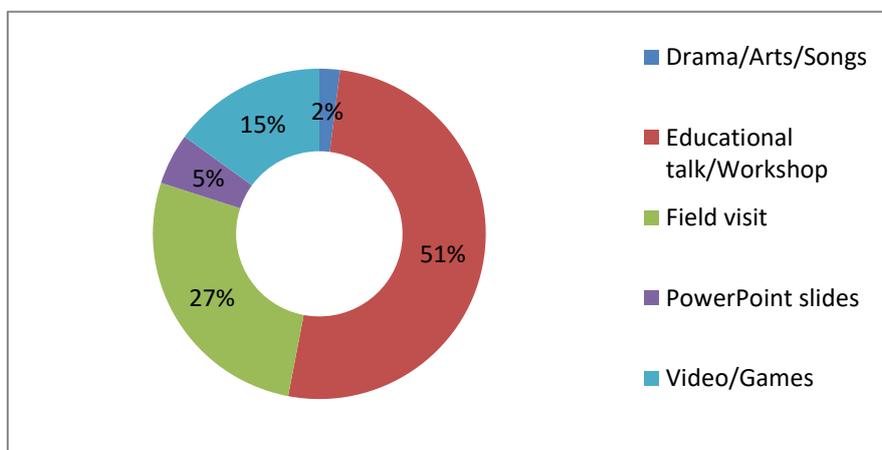
Their high knowledge level of wastewater and its sources reflected in their attitudes towards its discharge. This is in line with Loubser et al. (2014) which emphasize that increasing the level of awareness of citizens helps to improve their attitudes towards the environment. Most of the respondents further supported the idea of wastewater treatment before discharge. According to UNDP (2019), 80 percent of wastewater goes into waterways without adequate treatment in developing countries. This was clearly depicted in this study as shown in Fig. 2 and it drives home the point that wastewater treatment is not too common in developing countries yet. For instance, Thailand has water pollution problem which results mainly from municipal wastewater generated from daily domestic and industrial activities (Sateinpong et al., 2014).

It is very interesting to note that a large number of the respondents (80%) believed that untreated wastewater has a negative effect on water quality. This was further validated by the recording of 75% for those that agreed that wastewater should adequately be treated prior to discharge into the water body. When asked if they know any type of wastewater treatment method, 65% recorded no while the remaining 35% said yes. Out of the 35% that recorded yes, the majority know of oxidation pond process of wastewater treatment, while chlorination and filtration were recorded as well by some respondents. Some other methods that were listed included but not limited to reverse osmosis, UV treatment, vemifiltration, use of water hyacinth and conventional treatment.

Pearson Chi square test was used to analyze the dependence of some variables and the following findings were recorded. The sex of the participants and their awareness level of wastewater and its treatment ( $p=.831$ ), the academic qualifications and awareness level ( $p=.163$ ). Furthermore, the attitude of the participants when compared to their academic qualifications has  $p$  value of .739 while exposure to environmental education and attitude was  $p=.041$ . The study therefore revealed that sex and academic qualifications of the participants are not associated with their awareness level. This is a contradiction to a previous research which indicates that level of education was positively associated with environmental awareness (Philppsen et al., 2017). This clearly shows that despite the level of education of the participants, various wastewater treatment methods especially the oxidation pond method are not yet known among them, hence, a need for the propagation especially in the developing countries.

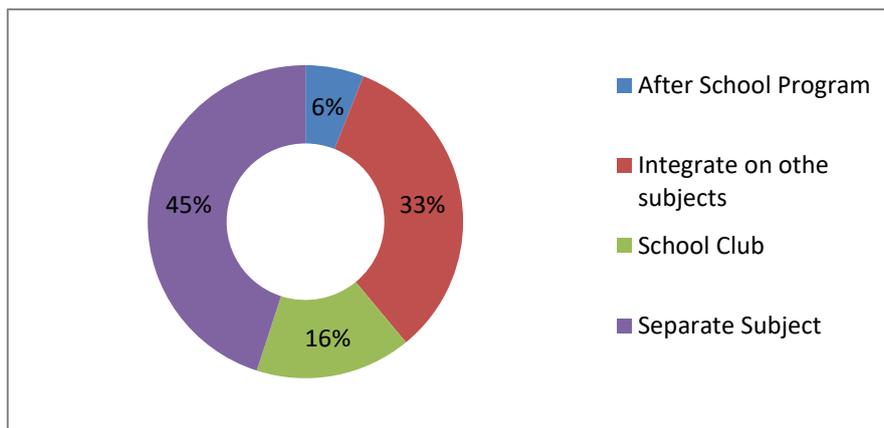
### 4.3. Environmental Education Awareness

78% of the respondents reported that they had not been involved in any wastewater education while 22% of them had been educated.



**Figure 3** Choice of respondents' environmental education methods (Source: Field survey)

On the other hand, 85% of the respondents had been exposed to one form of EE or the other while 15% of them had not. The respondents' preferred choices of the best method of teaching EE are shown on Fig. 3. Interestingly, 90% of the respondents suggested that EE should be made compulsory in school curriculum and 10% said maybe. None of them opposed the idea. In responding to the question of the best method of teaching environmental education, environmental talk and workshop (Fig. 4) was the highest (51%) and this observation corresponds with the study of Loubser et al. (2014) which found out that this method recorded a positive outcome with high level of satisfaction among the workshop participants in Malaysia. This is a positive indicator of the success of any EE program. Moreover, exposure to environmental education was seen to be a contributor to improved good attitudes towards the environment (Loubser et al., 2014).

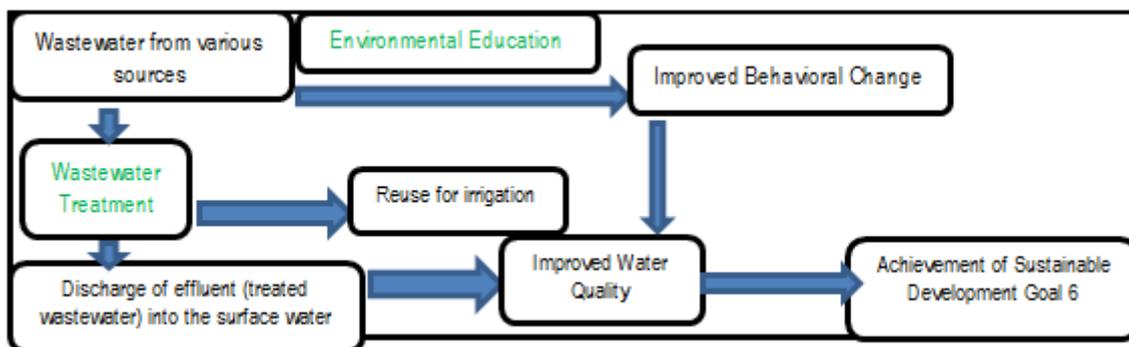


**Figure 4** Different options on how to teach environmental education in schools (Source: Field survey)

The study showed that the majority of the respondents believe strongly that environmental education is a very useful tool in solving environmental problems (89% in favor of it). Although 85% of the study participants reported that they had undergone one form of environmental education or the other, only 22% of them were exposed to wastewater education. This explicitly helped to explain their low awareness level on oxidation pond method of wastewater treatment which His Majesty King Bhumibol Adulyadej established in Phetchaburi, Thailand to naturally treat municipal wastewater before discharge into the Phetchaburi River. This project has been successful and a model for environmental improvement and conservation through natural process. Previous study by Hoang and Kato (2016) shows that environmental education contributes to increase in environmental knowledge of students in Vietnam. In addition, ecological behavioral change was also recorded after nature-based environmental education. And this has been stated to be a right approach to improving behavioral change among people towards the environment (Otto and Pensini, 2017). Combined approach of wastewater treatment and environmental education (Fig 5) can therefore help Thailand achieve United Nations sustainable development goal 6 (clean water and sanitation) if well implemented.

Thathong (2010) explained that environmental issues were not directly taught in Thai school-based curriculum but were integrated into some subjects. Environmental education, however, is beneficial to policy makers, educators as well as stakeholders in achievement of sustainable development goals. It also promotes critical thinking, problem solving and decision making skills (Aminrad et al., 2013; Holt and Barkemeyer, 2012; Karataş and Karataş, 2016; Rickinson, 2001). Moreover, Athman and Monroe (2001) revealed that awareness and knowledge of environmental processes and systems play important roles in behavioral outcome. In line with these arguments, the study recorded the majority of the respondents (90%) suggesting that environmental education be made compulsory in all

schools. Notable in this research was report of 89% of the participants believing that environmental education is a useful tool to solving environmental problems.



**Figure 5** Using Wastewater Treatment and Environmental Education as Tools in Water Quality Management (Developed by the researcher)

## 5. CONCLUSION AND RECOMMENDATIONS

Although 85% of the participants reported that they had been involved in one form of environmental education or the other, only 22% were involved in wastewater education in particular. This clearly explains the reason for their low level of awareness on oxidation pond method of municipal wastewater treatment which has been in existence in Thailand since 1996. It was also found out that the high knowledge level of the respondents in wastewater and its generation sources led to better attitudes towards how they discharge used water. Hence, environmental education was identified as a powerful tool to promote the awareness level in schools and improve behavioral change. This is very important in developing nations especially Thailand. Among the methods listed, educational talks/workshop was identified to record the highest approval among the respondents. Teaching environmental education as a separate subject was identified by the participants as the best way to introduce it in schools.

The findings from this study can be used by decision and policy makers to promote the teaching of environmental education with special emphasis on wastewater education in schools which will contribute to behavioral change of the students and the general public towards water bodies. This will in turn help to improve quality of our water bodies (in accordance with United Nations Sustainable Development Goal 6- Clean water and sanitation). In addition, this study will be of immense help to future researchers with interest in similar study as the researcher experienced limited access to related materials in the course of this study. No previous study has directly discussed the public awareness level of wastewater and its treatment especially in Thailand.

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## CONFLICT OF INTEREST

The authors declare that there is no known conflict of interests regarding the publication of this manuscript. Also, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/ or falsification, double publication and/or submission have been completely observed by the authors.

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