EMPOWERING TEACHERS AND STUDENTS LEADERSHIP ON SDG 2 AND SDG 6 VIA INTEGRATED GREEN GARDEN

by

RCE Penang
# Table of Contents

1.0 INTRODUCTION .................................................................................................................. 2  
   1.1 Objectives ......................................................................................................................... 4  

2.0 LITERATURE REVIEW ........................................................................................................ 4  
   2.1 What is Water? .................................................................................................................. 4  
   2.2 SDG 6 – Clean Water and Sanitation ............................................................................. 5  
   2.3 Framework ..................................................................................................................... 5  
   2.4 School Garden ............................................................................................................... 7  

3.0 METHODOLOGY ............................................................................................................... 8  
   3.1 Questionnaire .................................................................................................................. 8  
   3.2 Workshops ..................................................................................................................... 8  

4.0 RESULT AND DISCUSSION .............................................................................................. 10  

5.0 FINANCE .......................................................................................................................... 14  

6.0 CONCLUSIONS ............................................................................................................... 14  

7.0 RESEARCH TEAM .......................................................................................................... 15  

8.0 REFERENCES ................................................................................................................... 16  

1.0 INTRODUCTION

Water plays an important role as it is a basic requirement to sustain life. Water is used for personal needs, irrigation in agriculture, and also in industry to produce various products. Water not only affect organisms directly, but also affect the economy and the environment globally. According to WWAP (2015), safe and clean water is an important element in sustainable development as it contributes to the reduction of poverty, the growth of economy, environmental sustainability and to improve the overall aspect of an individual such as health aspect and food supply.

Unfortunately, Bendfeld, Broker, Menne, Ortjohann, Temme, Vob, and Carvallo (1998) stated that 99% of water on earth is saline or contaminated, only 1% of it is fresh water and can be drink. This little amount of fresh water is inadequate to sustain all the lives on earth. According to Fiorenza, Sharma and Braccio (2003), around one fourth of mankind is suffering from inadequate fresh water supply. Added to this, the growing water demands from population growth, economic development, and increased per capita consumption of goods and service are the driver to water scarcity, stated by WWAP (2009) and Vorosmarty, Green, Salisbury, and Lammers (2000). As rivers and lakes are water sources to most of the organism, the condition become worse when more and more rivers and lakes get polluted by industrial waste and the large amount of sewage discharged. On a global scale, man-made pollution is the largest causes for fresh water shortage as mentioned by Kalogirou (2005).

Groundwater is another source to provide drinking water to humans and animals and it is also used for irrigation in agricultural sector. However, the source for groundwater is reducing due to several factors. Polluted groundwater, global warming which cause intrusion of salt water into coastal areas and over exploitation by human beings for different uses and the slow rate of recharging groundwater causes water shortage (WWAP, 2015). According to Russo, Alfredo and Fisher (2014), the numbers of people who are experiencing shortage of water are increasing every year. 50% of the world population will live in water shortage regions as stated by Quist-Jensen, Macedonio, and Drioli (2015). Water available for use is gradually decreasing if we do not conserve it.

For this reason, water education is needed. Teachers need to be exposed in various ways such as water saving, water reuse, recycle in ensuring water is sufficient for future generation. Our workshops will facilitate, educate and promote awareness, knowledge, appreciation and stewardship about water use. Therefore, teachers will be exposed to hands-on and minds-on activities in providing experiences about the sustainability of water use. Thus, this module development is necessary.
Modules has logical links between learner needs, learning outcomes, teaching strategies and resources (Donnelly and Fitzmaurice, 2005) and directions to students to perform the tasks (Choo Mei Cheng and Marina, n.d). It allows teachers to get ideas to execute activities accurately. Thus, the misconception problems will be minimized. However, our modules are very flexible since teachers are allowed to expand the activities that are relevant to the concepts.
1.1 Objectives

The objectives of this grant are as below:

i. To give knowledge about the sustainability of water use
ii. To create awareness on clean water shortage
iii. To protect and enhance no water wastage
iv. To promote and educate teachers about water care activities
v. To inculcate values towards water
vi. To encourage young children to advocate issues about water by engaging with water authorities
vii. To empower teachers’ and students’ leadership on SDG 6 via Integrated Green Garden

2.0 LITERATURE REVIEW

2.1 What is Water?

Water is a molecule that is made up of two hydrogen atoms and one oxygen atom. When these three atoms come together, they form a strong bond that is difficult to break. This strong bond keeps a water molecule together for millions and even billions of years. Water is a main component of earth’s rivers, lakes, oceans and fluids for all living organisms. It is colorless, odorless, tasteless and transparent and its cover over 70% of the Earth surface. Similarly, 70% of our body is covered with water. Water is a source of life, livings and prosperity. It is as well an important input for almost all types of the productions, agricultures, industries, energy, transport and so on (Grey and Sadoff, 2007). It is an essential element in maintaining the life and it is needed for the survival of all organisms (Azlan et al., 2012). Water are valuable and useful to humans. It has been known for millennia that human survival and ecosystem conservation depends on the reliable availability of adequate water of appropriate quality (Asian Water Development Outlook, 2007). Without water, all forms of life could never exist and will not survive. The earth is probably the only planet in the vast universe that has lives on it and the only reason is because the earth is blessed with abundant of water (Zakaria et al., 2011).
2.2 SDG 6 – Clean Water and Sanitation

In SDG 6, the objective is to ensure the availability and sustainable management of water and sanitation for all. This is due to the global freshwater problems. Fresh water ecosystem is vital for human healthy living, environmental sustainability and economic prosperity.

Healthy living refers to good physical and mental health. Every human needs a balance diet and a sufficient water to ensure the digestive system functions properly. In addition, toxic from digestive system by products can be flush out.

Environmental sustainability refers to the ability to maintain qualities that are valued in the physical environment (Sutton, 2004). For example, in order to have a healthy life, human needs clean water, unpolluted air and environment. We must make sure that our natural environment would not decline in term of its quality.

Economic prosperity refers to the quality of life in ensuring every individual to be having an equal living standard in a competitive economic world. Nevertheless, despite the search for wealth and material goals, it is essential for individuals to be well-balanced in terms of physical, mental and spiritual aspects.

2.3 Framework

In this module development, the activities are designed by intermingling the stakeholders’ need and the learning theory to infuse in the current practices of teaching and learning processes. For the module design, the theory of constructivism is used. Through constructivism, children are given the opportunities to explore the activities in order to build their own understanding about certain concepts. The activities should be hands-on as it allows children to learn by executing the tasks given. This learning approach would provide a meaningful learning experience to the children.

To implement constructivism approach in a classroom, certain strategies could be used such as inquiry-based learning or problem-based learning. Both strategies use questions to stimulate children’s curiosity. According to The Access Center, 2000, inquiry is an interactive, question-driven, exploratory and explanatory approach that helps children to be active during the learning process. In fact, this approach is able to develop the children’s potential to an optimum level of all aspects according to children’s uniqueness (Noraini and Nik Noriah, 1992). It as well allows children to "perceive" their thinking and analyze the knowledge in the activity (Dyasi, 2000). Dyasi also pointed out that inquiry may contribute to social and intellectual development of the children.
Based on the published article (The Access Center, 2000), there are three types of inquiry as in Table 1 below:

Table 1
Types of Inquiry (adapted from The Access Center, 2000)

<table>
<thead>
<tr>
<th>Types of Inquiry</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured Inquiry</td>
<td>Teachers instruct children to do step-by-step investigation based on the hands-on activities. The activities are selected by teachers. Answers are given to the children.</td>
</tr>
<tr>
<td>Guided Inquiry</td>
<td>Teachers guide children to investigate based on the hands-on activities. The activities are selected by teachers. Teachers discuss with children in finding the answers.</td>
</tr>
<tr>
<td>Open Inquiry</td>
<td>Children conduct investigations based on hands-on activities. The activities are chosen by children. Children look for answers / solutions based on their observations.</td>
</tr>
</tbody>
</table>

The module design adapted the guided inquiry in the module development as it conforms to the 21st century learning style where student centered learning is emphasized. In guided inquiry, a teacher will act as a facilitator in guiding children to explore the activities. Questions are essential as it stimulates children’s thinking.

While, the other approach that we propose is a combination of Problem-Based Learning (PBL) and 5Ts of action leaning by WESSA. In PBL, an ill structured problem is needed. According to Shin, Jonassen and McGee, ill structured problem is a problem where students face regularly in daily life. By using the ill-structured problem method, student first need to decide if there is a problem because the ill-structured problem may not appear directly in the questions (Jonassen, 1997). Students will be given opportunity to discuss among themselves regarding the identified problems and construct a representation of possible solutions (Sinnott, 1989; Voss & Post, 1988).

In this module, PBL will be integrated with 5Ts of Action Learning developed by Wildlife Environment Society of South Africa (WESSA). The 5Ts of Action Learning is provides foundation for deliberative learning where students can use what they know to make sense of what they see.
and experience to construct possible solutions for a problem (Leicht, Heiss and Byun, 2018). We propose this method because it support co-engaged social learning where concerns meet and shared. This is essential for students to connect their understanding to the learning experience to come. For this reason, a teacher should be able to problem to empower students on 21st century learning style.

The completed module can be used by the teachers as a guideline to implement activities focuses on SDG 6 and 4Cs (Critical thinking, Creativity, Collaboration and Communication) which required for the 21st century learning and SDG 17. Figure 1 is the framework of our modules.

![Module Framework](image)

Figure 1: Module Framework (adapted from Donnelly and Fitzmaurice, 2005)

### 2.4 School Garden

School garden have a practical and dynamic opportunity to link students with nature (Bundschu-Mooney, 2003). By having the school garden, it helps student engaged in maintaining garden and practice environmental stewardship (Alexander et al., 1995; Mayer-Smith et al., 2007; Pothukuchi, 2004; Waliczek et al., 2001). According to V.Plaka and C. Skanavis, school gardens can be infused into the educational curriculum not only to enable students to learn about plants, nature and outdoors but also other subjects like history, economics, mathematics and science studies. There is also another study indicated that designing and maintaining gardens show an increase in self-efficacy. (Lekies et al., 2006; Poston et al., 2005).
3.0 METHODOLOGY

3.1 Questionnaire
This program had used a questionnaire for collecting data which was adapted with major modification from another questionnaire developed by United States Environmental Protection Agency entitled *Hey Kids, It's Time to Test Your WaterSense!* (EPA, 2017). There were thirteen items in the questionnaire mainly focus on water sense. The questionnaire was distributed to pre-school teachers, primary school teachers, secondary school teachers and primary school students. The returned questionnaires were analysed using score ranking method. The scoring criteria were divided into three level which are *WaterSense Genius* (9 or more questions correct), *WaterSense Expert* (6-8 questions correct) and *WaterSense Novice* (Less than 6 questions correct).

3.2 Workshops
There were series of workshops has been organized and implemented through out the development of the module. The participants of the workshop were pre-school teachers, primary school teachers and primary school students. Below are the successful workshops that has been organized in 2019:

i. Pre-school teachers' workshop on Integrated Green Garden – 16 February 2019
ii. Primary school teachers' workshop on Integrated Green Garden – 01 March 2019
iii. Water Education workshop at SJKC Eok Hua, Teluk Bahang – 20 March 2019
iv. Water Education workshop at SK Sungai Nibong – 18 April 2019

The were various of activities have been carried out during the workshops. For the teachers' workshop, the first activity was introduction to water education which focuses on water issues, SDG 6 and the concept on how the implementation of Integrated Green Garden could help us save the water use in daily activities especially for urban gardening by Dr Nooraida Yakob. After the introduction session, the teachers were brought to the Integrated Green Garden prototype that was developed by Mr Mohamad Hafiz Ahmad. The Integrated Green Garden was developed using few techniques such as rain water harvesting system, *batas apungan*, drip irrigation and *sistem kompos RCE Penang*. Rain water harvesting system is an alternative water supply for outdoor activities such as watering of vegetables, washing equipment and vehicles, washing floor and toilets and various uses. This method will reduce the consumption of treated water for daily activities. It will save on their monthly bill payments. *Batas apungan* is a technique that used to build a portable vegetable plot on a soil or rock surface without altering its original physical
structure. It is a gradual arrangement of bricks that connected to each other to form soil reservoirs. The soil reservoir serves as a vegetable growth medium.

Drip Irrigation is a technique that used to watering plant directly to the root by minimum of water consumption. This technique will help the root to absorb almost the entire drop of water.

*Sistem Kompos RCE Penang* is a technique to converted organic wastes into compost by employing earthworms or microbial cultures. Vermicomposting can be done ideally in plastic storage box that located under shaded conditions to maintain appropriate quantity of substrate, optimum moisture and temperature which are necessary for efficient vermicomposting. This will also provide an opportunity to provide protection for the worms from predators like rodents, ants, bird, and dogs.
4.0 RESULT AND DISCUSSION

During the workshop, we have distributed a set of questionnaires on water sense to identify the level of awareness on water consumption among the preschool teachers, primary school teachers and secondary school teachers. The questionnaire contains 12 questions regarding the water use and water awareness. Below is the result of the descriptive statistic on the score collected:

Table 2
Descriptive Statistics on Pre-School Teachers’ WaterSense Scores

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Score</td>
<td>20</td>
<td>3.00</td>
<td>8.00</td>
<td>5.10</td>
<td>1.41</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the result, the maximum score among the teachers is 8 and minimum score is 3. The mean score for the water sense among teachers is 5.1. From the findings, it showed that 2 pre-schools teachers have a low level of water sense, 14 pre-school teachers have moderate level of water sense and 4 pre-school teachers have a high level of water sense. Thus, it can be concluded that the level of water sense among pre-school teachers is moderate. For item no 3, 4, 5, 7, 8, and 11, majority of the pre-school teachers did not answer correctly since these items reflect on their logical thinking about water used and their practice.

Table 3
Descriptive Statistics on Primary School Teachers’ WaterSense Scores

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Score</td>
<td>34</td>
<td>3.00</td>
<td>10.00</td>
<td>6.15</td>
<td>1.46</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the result, the maximum score among the teachers is 10 and minimum score is 3. The mean score for the water sense among teachers is 6.15. From the findings, it showed that 10 schools teachers have a low level of water sense, 22 teachers have moderate level of water sense and 2 teachers have a high level of water sense. Thus, it can be concluded that the level of water sense among school teachers is moderate.
Table 4

Descriptive Statistics on Secondary School Teachers’ WaterSense Scores

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Score</td>
<td>11</td>
<td>4.00</td>
<td>8.00</td>
<td>6.1818</td>
<td>1.25</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4 demonstrated the result of WaterSense quiz among eleven secondary school teachers. This questionnaire was distributed informally during water camp program organized by UNESCO-IHP Malaysia. Based on the result, the maximum score is 8 and the minimum score is 4. The mean score is 6.18 which indicated that most of the teachers are WaterSense Expert. Three teachers score below 6 which considered as WaterSense Novice and eight teachers were considered as WaterSense Expert which score between 6 to 8.

These findings demonstrate that teachers need to be exposing to water related activities and water saving activities that can lead to water awareness. Thus, this module is essential for the teachers to enhance their water sense level and water awareness especially on the sustainability of water use. With that, teachers would be able to become an agent to transfer the knowledge and skills to their students.
Table 5
Descriptive Statistics on Standard Five Students WaterSense Scores

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Total Score</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
</tr>
</tbody>
</table>

Table 5 shows the result of Standard Five students’ on WaterSense quiz which was distributed to 21 students in primary school in Penang. The maximum score is 7 while the minimum score is 2. The mean score of 4.48 indicated that most of the students fall under WaterSense Novice. From this finding, we concluded that it is vital to infuse Water Awareness Educational Programme into schools’ curriculum and co-curriculum to inculcate a sense of responsibility amongst school children in terms of the value of water, water use and saving water.

Apart from the quiz, we also conducted an interview for the stand five students. Below are the questions and answers that we collected during the interview session:

<table>
<thead>
<tr>
<th>Questions</th>
<th>Group Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What are the currents water issues in Malaysia?</td>
<td>1. Many people wasting water in their daily life 2. Malaysia’s lack of clean water supply</td>
</tr>
<tr>
<td>2. Why people wasting water in their daily activities?</td>
<td>1. Lack of awareness about water education 2. They take clean water for granted, hence use it without control 3. People do not aware that Malaysia is running out of water. 4. Some people are wasting water while taking a shower for too long.</td>
</tr>
<tr>
<td>3. Why we need to use water wisely?</td>
<td>1. So that, we do not waste water in our everyday activities. 2. So that, we can ensure there is enough water for future generation</td>
</tr>
<tr>
<td>4. What did you learn by observing the integrated green garden developed at your school?</td>
<td>1. The garden reuse the air conditioner water to water the plants 2. Can help the school save the water usage 3. Can reduce the water bill consumption</td>
</tr>
</tbody>
</table>
Based on the interview, we concluded that the students lack awareness regarding the current water issues in Malaysia. Therefore, this module development could help the teachers to infuse water education specially to practice hands-on and minds on water as well as SDG 6 in their lesson plans. The water education not only focuses on creating awareness on the water issues but also to empower students' as the change agent for water education in Malaysia.
5.0 FINANCE

Total grant received: **RM 15,000**. The total expenditure is as shown below:

<table>
<thead>
<tr>
<th>Vot</th>
<th>Vot Breakdown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td><strong>Travel and Subsistence</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Train and Grab fare to Water Camp by IHP</td>
<td>120.75</td>
</tr>
<tr>
<td></td>
<td>Toll fare to site visit at Tabika Kemas Alma</td>
<td>10</td>
</tr>
<tr>
<td>26</td>
<td><strong>Supply of Raw Materials</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuel to site visit at Tabika Kemas Alma</td>
<td>25</td>
</tr>
<tr>
<td>27</td>
<td><strong>Supply of goods and other materials</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Materials for Integrated Green Garden (pipes, bricks, cocopeat)</td>
<td>3778.23</td>
</tr>
<tr>
<td></td>
<td>Purchasing of various of vegetables seedlings</td>
<td>100.05</td>
</tr>
<tr>
<td>29</td>
<td><strong>Services and Hospitality</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meals for Preschool workshop</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Honorarium for Preschool Teachers</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>Honorarium for Integrated Green Garden Experts RM 900 x 7 months</td>
<td>6300</td>
</tr>
<tr>
<td></td>
<td>Honorarium for Module Editing</td>
<td>650</td>
</tr>
<tr>
<td></td>
<td>Honorarium for Project Manager</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>Project Management</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td>Project Development at SK Sg Nibong</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>Draft module printing RM 14 x 15</td>
<td>210</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>14994.03</strong></td>
</tr>
</tbody>
</table>

6.0 CONCLUSIONS

In conclusion, water is an important element in life. Thus, using water wisely is essential in daily life. The availability of water modules as well as the implementation of Integrated Green Garden has made teachers and students more aware of water conservation.
7.0 RESEARCH TEAM

Project Manager
Nooraida Yakob

Assistant Project Manager
Nur Syazwana Hamzah

Content Expert
Munirah Ghazali
Rabiatul-Adawiah Ahmad Rashid
Mohammad Zohir Ahmad@Shaari
Muhammad Hafiz Ahmad

Secretariat
Wan Sharipahmira Mohd Zain
Kamsiah Kamaruddin
8.0 REFERENCES


Choo Mei Cheng, Marina Binti Abu Bakar The Impact of Using Modules in The Teaching and Learning of English In Malaysian Polytechnics: An Analysis of The Views And Perceptions of English Language Lecturers Jabatan Pengajian Am, Politeknik Melaka, Jabatan Pengajian Politeknik, Kementerian Pendidikan Malaysia


