EMBEDDING WATER CRISIS AWARENESS IN MATHEMATICS EDUCATION AT PRIMARY SCHOOL, KINTA UTARA DISTRICT, MALAYSIA

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ABSTRACT: *As 21st-century citizens, it is essential to use Mathematical literacy and knowledge to address global issues like environmental protection, sustainability of natural resources, and developing social awareness nationally, regionally, and globally. Thus, it is essential to embed Global Citizenship Education (GCE) in Mathematics education. This study is carried out to embed water crisis awareness in Mathematics teaching by analyzing and developing a Mathematical lesson that associates water conservation in the learning of Data. The lesson was planned with a thorough analysis of the Year Six Mathematics syllabus, narrowing down to the topic Data with proper and suitable learning materials and methods. A total of 31 Year Six students participated as samples in this study who had employed the pre-survey and post-survey in the form of questionnaires. The pre-survey was conducted three days before administrating the lesson, then a post-survey was conducted after, to measure the awareness of the students on water crisis after the lesson was taught. The qualitative data was collected through teaching observations, video recordings, students' responses, and assessments, which were analyzed. The data from samples were then collected and analyzed using the Statistical Package for Social Science (SPSS) via paired t-test to obtain the significant value. As hypothesized, the result shows that there is a significant difference among the students' awareness towards water crisis based on pre and post-survey. The goal of GCE is to enable the students to gain the proper knowledge and obtain the necessary skill that is required to create a more balanced and efficient world.*

Keywords: Water Crisis Awareness, Global Citizenship Education (GCE), Mathematics Education

1. INTRODUCTION

Mathematics is for all students in all countries, which is a principle of equity [1]. Apart from being an essential knowledge for self-sustainability, Mathematics education has an adequate role in creating a high level of Mathematical literacy so that students would be able to have a wide range of skills and knowledge that can be embedded with life and global knowledge affluence [2]. As 21st-century citizens, it is also essential to use Mathematical literacy and knowledge to address global issues like environmental protection, sustainability of natural resources, and developing social awareness nationally, regionally, and globally; thus, it is essential to embed Global Citizenship Education (GCE) in Mathematics education [3].

To embed the water crisis issues using the topic Data in the Standard Curriculum for Primary School (SCPS) of Year Six Mathematics, the Content Specific Table (CPT) was referred. The learning objectives of the lesson designed for this study were for students to construct and interpret data from bar charts while relating water conservation in daily life activities. Bar charts regarding water scarcity around the world were presented to students, where they later discussed and interpreted the data derived from their observation. Students were then, given a series of lessons delivery and learning materials in the form of videos, illustrations as well as online assessments to discuss types of water usage activities in their daily lives and how water can be conserved through new alternatives upon practicing better water management.

Mathematics education is much more suitable to be associated with GCE upon addressing environmental issues, climate change, water crisis, agriculture, and promoting sustainable development [4]. These issues are easily understood by scientifically and mathematically literate students [2]. GCE in Malaysia is still at a moderate level where it is not being implemented as an independent subject in the curriculum [5]. However, according to [6], implementing this subject in the school curriculum is essential to creating a desirable global community. Through this subject, every individual will feel responsible for showing an excellent example to the younger generation. Therefore, it will ensure that the nature of civilization, compassion, peace, and harmony can be developed; thus, embedding the water crisis while teaching Mathematics education in Malaysia at the primary level would be a stepping stone upon realizing UNESCO's outline [4]. To justify this attempt, this research helps to identify the student's awareness before and after the implementation of GCE on water crisis in Mathematics lessons among Year Six students.

Research Hypothesis

Based on the research question and research objective, below are the hypothesis tests for this study;

H_0 = There is a significant difference between pre and post-survey results of the student's awareness of the water crisis in mathematics lessons.

2. LITERATURE REVIEW

Various educational programs are implemented in Malaysia for children. There are two categories, namely, secondary education and post-secondary education [7]. Through the National Education Philosophy, Malaysia aims to produce skilled and capable individuals who are well-educated and have high moral standards [8]. The Education Blueprint 2017-2020 was introduced to transform the education system of Malaysia. It was made due to the drastic decline in the country's PISA scores [9].

GCE Through Mathematics Lesson

Global citizenship is a concept that involves the participation of various people from different nations and communities. It is a concept that can help us discuss global issues and problems [10]. The role of GCE in the curriculum and teaching is acknowledged by UNESCO. This module outlines the various components of GCE and their respective objectives [4]. Global Citizenship Education mainly focuses

on developing the students' knowledge and skills related to the principles of international law, democracy, and the responsibilities of nations [4].

Considering this, in the Malaysian Education Blueprint 2013-2015, the concept of civics education is identified as one of the vital elements in education to address the global challenges posed by the 21st century [11]. Civics education is integrated into the teaching of various subjects. This curriculum is used for the development of critical thinking and creativity [12]. The concept of Global Citizenship Education is related to the core objectives of the Mathematics Standard-based Curriculum. These objectives are: developing higher-order thinking, creative thinking and reasoning, and exploring daily life mathematically [12].

3. RESEARCH DESIGN

The study was conducted using development research; the ADDIE development model and quantitative analysis through survey method. According to [13], the ADDIE development model is a framework used for developing effective and efficient processes and systems. It consists of five phases, which include analyzing, designing, developing, implementing, and evaluating which are used to create a lesson plan to introduce Global Citizenship Education (GCE) in Data. The survey method was used to identify the effectiveness of the lesson plan through a pre and post-survey. Various steps were involved in the process, such as creating the questionnaire and gathering the data. Then, the quantitative data collected from the sample were then analyzed using SPSS. The result of the paired t-test is discussed and given justification.

Population and sample

The study was conducted in a primary school located at Kinta Utara district. The convenient sampling method was chosen for this study. Convenience sampling is a method of gathering market research data from a pool of respondents. It is very popular among researchers due to its simplicity and economic nature [14]. The participants were chosen based on their availability and willingness to respond [15]. Hence, 31 out of 110 of standard six students from a primary school of Kinta Utara District in the academic year of 2021 were selected as samples.

Instruments

The module developed for this study involved the development of an instrument that measures the student's awareness about Global Citizenship Education. A total of six items was developed. The instruments are developed to provide feedback about the student's understanding of the topic. Students were requested to rate the extent to which they agreed or disagreed on a Likert scale of 5 points. The options are 1 (strongly disagree) to 5 (strongly agree).

Validation of Instrument

The students' awareness of Global Citizenship Education in the context of the water crisis questionnaire was validated by two experts in the field of Global Citizenship Education and mathematics education. Experts accepted all the items with some minor changes. The items are in the following table.

Table 1: Items on Students' awareness on water crisis through Mathematics Lessons

No	Items	1	2	3	4	5
W1	I learned the importance of water during my mathematics lesson	1	2	3	4	5
W2	Mathematics lessons create awareness that wasting water is a bad habit	1	2	3	4	5
W3	I started to use the water wisely after learning in a mathematics lesson	1	2	3	4	5
W4	The mathematics lesson makes me realize that people are suffering from a lack of clean water	1	2	3	4	5
W5	I encourage my family members to save the water after learning in mathematics lessons	1	2	3	4	5
W6	Mathematics lessons taught me how to appreciate water	1	2	3	4	5

Pilot Study

A pilot study is a type of research that was carried out before the main experiment was conducted, to assess the feasibility, methodology, and possible problems of the study. The pilot study sample size was selected per literature standards. The sum of the test's error was determined by the Cronbach's Alpha coefficient procedure. Cronbach's coefficient has a lower permissible limit of 0.72 in general. It may, however, be appropriate at 0.60 [16]. Both constructs of this study (pilot test) are stable, as seen in Table 2 (alpha Cronbach is more than 0.7).

Table 2: Reliability of Mathematics Homework Engagement constructs in the pilot test

Global Citizenship Education	Number of items	Coefficient Alpha
Water Crisis (3)	6	0.906

Table 2 indicates the rotated component matrix. The findings show that there are four factors and all loading factors are more than 0.5. As a result, there is no issue about the convergent validity of the pilot test' constructs.

Table 3: Rotated Component Matrix

Items	Global Citizenship Education (Water crisis)
W2	.917
W1	.915
W3	.901
W6	.889
W4	.854
W5	.833

The alpha reliability coefficients for the various items were acceptable. The pilot study revealed that these items would remain in the main study.

5. FINDINGS AND DISCUSSION

This section presents the data collected during the study and its justifications. Thirty-one respondents were selected from Year Six students, who are all females. The study was conducted to analyze the students' awareness of the water crisis through the lesson of Data.

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Table 4: Paired t-test results

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N	Pre-survey		Post-survey		Mean Difference	t-value	Significance value
	Mean	SD	Mean	SD			
31	2.7258	0.94040	3.8925	0.85802	-1.16667	-4.619	.000

As shown in Table 4, there is a difference in the pre-survey and post-survey, which were conducted to analyze the difference in awareness of the students towards water crisis through mathematics lessons. The mean value of the pre-survey for the 31 students is 2.7258 with a standard deviation of 0.94040, while the post-survey has a mean of 3.8925 with a standard deviation of 0.85802. This shows the increase in awareness towards the issue after the lessons were conducted. There is a significant difference between the pre-survey and post-survey, [t_{30} = -4.619, p < 0.005]. The mean difference between the two surveys is -1.16667. This has proven that the students were able to connect Data with the water crisis. As [17] have mentioned in their work, exposing the students to water crisis had increased their awareness towards the issue and be able to analyze the related issues and practice responsible usage of water.

6. IMPLICATIONS

The integration of GCE into mathematics lessons will ensure that there is a life-long effect on the students, as they implement their critical mathematical thinking towards their daily life and contemplate global issues. This coincides with the work of [18], which discusses how mathematics can be used to study and improve the world. By implementing GCE into the Malaysian education system, educators will be able to create a future generation that is well aware of the global issues and be prepared to step up when help is needed. This is parallel to the SCPS designed by the Ministry of
Education Malaysia, which focuses on the application of Mathematics in daily life and solving problems by using Higher Order Thinking Skill (HOTS) on a global scale by showing leadership skills, knowledge, and thinking ability [19]. Through the implementation of GCE, the students would also be well prepared to gain global education and be well adapted as global citizens. The goal of GCE is to enable the students to gain the proper knowledge and obtain the necessary skill that is required to create a more balanced and efficient world [20].

7. SUMMARY

This study has been conducted to investigate the integration of the water crisis into mathematics education. The result of this study had shown that integration of water crisis into mathematics lessons could raise awareness towards the issue while cohesively gaining knowledge. To improve the integration of GCE into the education system, more study needs to be conducted to determine the best way of balancing exposure towards a global crisis and education. This study has been led to be a stepping stone for future researchers who want to explore Global Citizenship Education.

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