



Smart Education System to Enhance Public Awareness about Climate Change: A Literature Review

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Abstract. Climate Change has become the greatest challenge of the 21st century threatening all aspects of society because it's caused severe changes for people, natural ecosystems and economies around the world. Indonesia is one of the countries most at risk of climate change impact. Knowledge of climate change is very important so people can take mitigation actions. This study aims to ensure the effectiveness of smart education systems to enhance public awareness about climate change. This research method using a qualitative systematic literature review was conducted in several publication platforms in the last 5 years with the search keywords used are; climate change, public awareness and smart education system. A total of 10 research journal articles were included in this literature review. The results of this research are the use of Augmented Reality (AR), Internet of Things (IOT), Artificial Intelligence (AI) and Educational Mobile Learning Apps has been shown to be effective in enhancing students' learning experience and well-received in terms of adopting and using such technology for educational purposes. Here, Ministries of Education and schools can play a major role in ensuring that students have access to technology and support climate change syllabus enrichment.

Keywords: Climate Change · Public Awareness · Smart Education System

1 Introduction

The issue of climate change has become a major concern nowadays. According to some experts, climate change has melted glacial zones and it caused the sea level to have risen. It also caused severe changes for people, ecosystems and economies around the world such as fatalities, ecological damage and economic losses. One of the countries most at risk of the impacts of climate change is Indonesia. Jakarta is one of the cities at risk of devastating impacts and one of the most heavily occupied cities. According to the Meteorology, Climatology, and Geophysics Agency (BMKG), climate change is the factor behind repeated severe floods in Jakarta. As a result of rising sea levels, Jakarta

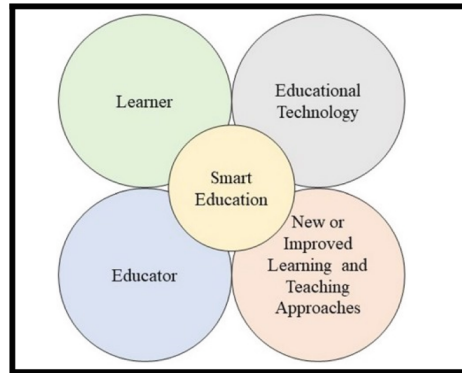


Fig. 1. Smart Education System

is estimated around 25% will be submerged in 2050. Nearly half of Jakarta is currently under sea level due to sliding at a rate of 1–15 cm each year.

According to a number of experts, there is a lack of public awareness about climate change. Knowledge about climate change is important so people can mitigate small things. Due to socio-economic conditions and the high number of the poor population, Indonesia is very vulnerable to the impacts of climate change. Indonesian children become vulnerable caused by mostly schools located in disaster prone areas [1]. Having interest in sustainable development in education has a lot to do with education reform. Majority of young citizens are not aware of the impact of climate change. Student awareness is necessary to guide their behavior towards their actions so the education nowadays must consist of knowledge of climate change and its mitigation to enhance student knowledge. Climate change education can help students address the impact of global warming. Knowledge on climate change and global warming is a part of environmental education that helps in students' development of a sense of responsibility through the creation of awareness.

The education system must be in line with society's development. The role of technology in education is important since it creates conditions for accessibility of education. Technologies enable the creation of an innovative digital learning environment where interaction between learners is possible so that education becomes more engaging and interesting among students. This situation will lead to the improval of the quality and efficiency of learning [2]. Smart education is a system that utilizes the potential of smart technology which can change the learning and teaching process. Based on the available information and knowledge, students will easily learn to make a decision. There are essential elements for smart education, the combination of learner, educational technology, educator and new/improved learning & teaching approaches as in Fig. 1.

2 Materials and Method

Literature review approach was used to understand all the relevant information related to Smart Education System, Public Awareness, and also Climate Change. Through a

literature review approach, the author will describe the things that public awareness regarding climate change and show how a smart education system effectively enhances public awareness regarding climate change. The authors use several platforms to search for relevant literature such as ProQuest, ZLibrary, Open Knowledge, Research Gate, and Emerald Insight. The authors use some relevant keywords, such as “smart education climate change”, “public awareness climate change”, “student awareness climate change”, and “smart education system”. The search was limited to literature that was published in the past 5 years and had gone through peer-reviewed processes. The author also searches for literature that has been proven and used as the known theory relevant to this research, information shared through credible news publications, white paper released by governmental research agencies and information available for the public from governmental reports. A total of 10 research journal articles were included in this literature review. In this literature review, there are limitations in searching for data, including the limitations of the topics sought, the use of English, the sources of articles, relevant topics, and of course the limited time in the preparation of this literature review.

Research Question

RQ1: How is the current state of public awareness regarding climate change?

RQ2: How can a smart education system effectively enhance public awareness regarding climate change?

3 Results and Discussion

3.1 Current State of Public Awareness Regarding Climate Change Among Indonesian

According to the national survey that was done by USAID, there are 2,097 respondents in all the 34 provinces of Indonesia that were conducted by the interview. Based on the survey result, about 78% of respondents are aware of the climate change issues (Fig. 2). There are 82% respondents know the human are the main cause that bring to climate change and 68% respondents are understand the impact of climate change [3]. In this national survey, the respondents can divide into five groups which is 48% respondents are understanding the cause and impact of climate change, 4% respondents who are understand the cause but not aware of the impacts, 10% who are aware the impact but not the cause, 16% respondents understand the climate change but not aware the cause and impact and 22% respondents are not aware completely of the climate change.

Next, a survey that have been conduct by a research team on 6 selected high school in Samboja district, Kutai Kartanegara regency, East Kalimantan province, Indonesia, there are total 360 students from different high school which is SMA Negeri 1, SMK Diponegoro, SMK Pesisir, SMK Al-Jabal Nur, MA Nurrudin, and SMA Harapan. In this survey, the respondents are from the first, second, and third grade students in six high schools in Samboja (Fig. 3). Among this group, there are 89% average respondents from the total six high schools are understand about climate change, 8% average respondents do not understand climate change and 3% average respondents do not answer the questionnaire about the understanding of climate change [4].

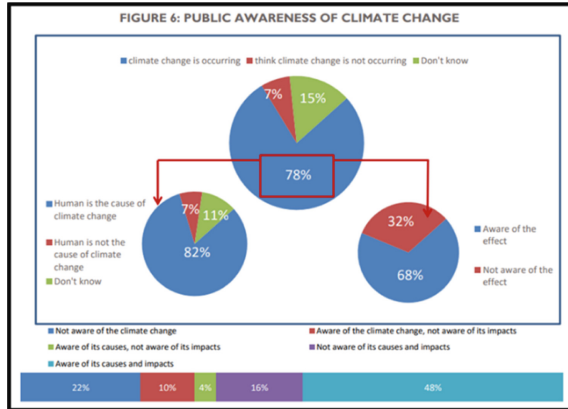


Fig. 2. Public awareness of climate change [3]

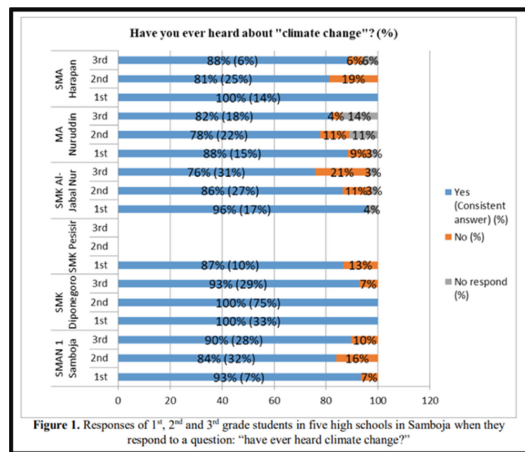


Figure 1. Responses of 1st, 2nd and 3rd grade students in five high schools in Samboja when they respond to a question: "have ever heard climate change?"

Fig. 3. Responses of 1st, 2nd and 3rd grade students in five high schools in Samboja when they respond to a question: "have ever heard of climate change?" [4]

On the other hand, syllabus content in geographic curriculum teacher lessons in Indonesia also will influence the understanding of the awareness about climate change (Fig. 4). According to the result analysis on the content related to climate change in the geography syllabus in 10th-12th grade, 21.99% are related to climate change. From this total, 7.7% in 10th grade syllabus content are related to climate change which is the types of climate change and global climate change, the characteristics of climate change and the impact to the human being and the effect of the climate change. There are also 14.29% in 11th grade syllabus content related to the climate change which is a disaster cycle, disaster prone in Indonesia and the mitigation of disaster through community in Indonesia. Furthermore, there is no content related to the climate change issue in 12th grade syllabus [1].

Grade	Number of Topics In Syllabus	Topics Related to CC	
		N	%
10	39	3	7.7%
11	35	5	14.29%
12	15	0	0
	Total		21.99%

CC: Climate Change

Fig. 4. Syllabus relate to climate change [1]

3.2 Smart Education System Effectively Enhance Public Awareness Regarding Climate Change

Engineering sustainability is a design process or system implementation in which energy and resources are sustainable, which does not harm the natural environment and generational abilities coming to fulfill their own needs, although many predecessors of sustainable engineering have been developed. Some of them that still exist will be described. One of the oldest is Environmental Engineering, which existed from the beginning of our civilization. Its modern approach started in the 1970s. This is a branch of engineering that deals with the adverse environmental effects of nature and human activities on freshwater supply, water and air pollution, wastewater and waste management, energy preservation, global warming, acid rain, sanitation, and agricultural systems [5].

Augmented Reality (AR)

Augmented Reality (A.R.) is the digital technology that has visual, sensory stimulation and delivers the data to enhance the version of the real physical world [6]. This technology is starting to grow among the mobile device and computing business companies. Nowadays, most of the researchers believe that the AR technology has given the benefit to the student in the educational learning process. The AR technology can generate the information or object to provide the real virtual environment to the student. This technology can generate the learning content in 3D objects to help the students who have difficulty in learning concepts and assist them to understand the learning process in the new environment. For example, AR games like Alien Contact! Simulation has been developed by using AR technology for middle and high school to allow the student to have the ability to solve the problem in teamwork and it can share the information among the students. This AR game has given the biggest positive impact to the student such as increasing the level of the student engagements [7]. Therefore, the game also can be developed using AR technology to increase the public awareness among the students in Indonesia. For instance, the teacher can use an AR game to create a complex question about climate change and allow the student working in a team to solve the question. With this, it can enhance the critical thinking among the students in understanding the awareness of climate change.

Internet of Things (IOT)

Internet of Things (IOT) is the computing system that can provide the unique identifiers and it has the ability to transfer the real time data over a network without human to computer interaction [8]. Nowadays, most of the organizations are using the IOT to understand the customer needs and enhance their satisfaction, improve decision making

and increase the business value. The IOT can be adopted in the learning process to provide the smart learning environment space to students and transform the traditional education system to intelligence tutorial system. For example, the researcher has advice to create the architecture learning space by using IOT in every education sector such as smart classrooms, smart library and smart laboratory. This smart classroom system can divide into four perspectives which is smart content, smart interaction, smart assessment and smart physical environment. This smart classroom system can analyze the student behavior and emotion recognition when doing the presentation. The smart classroom system also can detect the level of the fatigue among the student and it can enhance the student learning performances [9]. Therefore, the IOT also can be adopted in the Indonesia education system to enhance their learning performance in the awareness of climate change. For example, smart library can be introduce by using IOT where to store the real time information about the climate changes include books, magazine, article and journal. With this, the students can easily access this system to enhance their knowledge about the awareness of climate change.

Artificial Intelligence (A.I.)

Artificial Intelligence (A.I.) can be defined as a simulation human intelligence machine that mimics human actions [5]. In the field of computer science, Artificial Intelligence (A.I.) has played an important role in responsible helping humans in daily work, learning and problem solving. The Artificial Intelligent (A.I) can bring the latest changes in the education field. Nowadays, there are some educational sectors that are using AI technology in creating an education platform for students. For example, Third Space Learning has been created using AI to help the scholars from London University College, such as make the teaching technique become more effective and efficient like giving the warning when teacher explanation is fast or slow. Next, the CTI also creates by using AI in providing the digital textbook and other online material such as practice tests and flashcards to students to enrich their knowledge [10]. AI robotics also can integrate in education in providing a sustainable environment and increase the quality education. For instance, the education sector in Indonesia can implement the VGo robot or known as Telepresence robot where they can put the video or material about the climate changes at the robot and move around between the classrooms or everywhere. Then, at the same time show the video to the student and enable them to interact with it [11]. With this, the student will know more about the awareness of climate change information through interacting with robotics.

Educational Mobile Learning Apps

Mobile learning application or known as M-learning is the learning process through smart electronic devices such as mobile phones, tablets and laptops [12]. Mobile learning applications can come from different forms such as podcasts, videos, quizzes apps and eLearning courses. Nowadays, smart mobile devices and other social media platforms have changed the generation behavior and created the Learning Management System (LMS) to provide students with a new learning environment. This system can support blended learning and enhance the knowledge and skill among the students whether they stay in a local country or distance learning. Smart devices with the combination of Learning Management System (LMS) can enrich the learning data environment where



Fig. 5. The screenshots present infographics for successful learning using images [13].

the student can access the knowledge without time and space restriction and increase the creativity of students in problem solving.

Some of the smart mobile applications can help in enhancing the awareness of climate change issues (Fig. 5). For example, climate change apps like PowerPup can allow the user to address the climate change issue and find the energy saving tips to protect the ocean environment. According to The Wallace and Bodzin, it reports there is an increase of students who are using the MobiLAP to increase their interest in science and technology especially familiar with climate change [13]. Therefore, the education sector in Indonesia can develop a climate change apps with the Learning Management System combination in every mobile device to provide the current information about the climate change issue like global warming, impact of climate change to human health and environment risk, ways to reduce the climate change and other essential information that relate to the environment issue. The climate change apps also can provide the mini test to test the knowledge about the awareness on climate change. With this, it can enhance and develop a new knowledge about global climate change among the students or public in Indonesia and help them to aware it.

4 Conclusion and Recommendation

This modern era climate change is the major problem. Climate change impacts every aspect in life, one of them is education. From the result we know that only 48% from 2.097 responden all around 34 provinces of Indonesia who understand the cause and impact of climate change. This small number shows that not everyone in Indonesia not every people knows and understands the cause and impact of climate change. This problem can happen because the education system in Indonesia does not talk much about climate change. From the result we can know that only 21,99% of the syllabus have climate change as material. From these two problems we can discuss the solution to

make more people know and care about climate change with a Smart education system that effectively enhances public awareness regarding climate change. Smart education uses modern technology like augmented reality (AR), Internet of things (IoT), Artificial intelligence (AI), and M-learning. With this method we can use modern technology to inform more people in Indonesia about climate change.

Enhancing environmental awareness and education in climate change can contribute to effective adaptation and mitigation. The United Nation framework Convention on Climate Change (UNFCCC) Article 6 on education, training and public awareness states that countries shall develop and implement educational and public awareness programs on climate change and its impacts. The Paris Climate Agreement (UNFCCC COP 21, 2015) Article 12 also reaffirms the importance of the role of education in enhancing climate actions. Governments especially Ministries of Education and stakeholder need to acquire the knowledge and tools to both understand the climate crisis (and its cause) as well as possible approaches to manage risks associated with climate change, besides that Ministries of Education and schools can play a major role in ensuring that students have access to relevant education on climate change through smart education system and syllabus enrichment [14].

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