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Promoting global citizenship using statistics: The role of synchronous communication technology

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Abstract. The potential of synchronous communication technology to enhance distance learning has been widely explored, yet there is very little research on how this technology can be used in mathematics classroom. On the other hand, global citizenship has been increasingly discussed in international education forum these last few years. This paper report how synchronous communication technology can support statistics lesson in promoting global citizenship, as well as the potential and suggestion on the use of synchronous communication technology in the classroom.

Keywords: synchronous communication technology, global citizenship, statistics

1. Introduction

Distance learning has seen tremendous growth in the past few years due to the invention of technology that allows direct one-to-one communication such as Adobe Connect, Skype, or Webex. They all part of synchronous communication technology, which enables instructions or communications to happen real-time and requires simultaneous participation of people involved [1]. This includes text chat rooms, audio/video conferencing, and shared whiteboards.

Synchronous technology has been enhancing distance education through their ability to enable communication despite geographical or temporal barrier. One obvious feature of distance learning is the feeling of isolation from other students, which contribute to the students' attrition [2]. This feeling of isolation can be lessened through creating a strong sense of community online through the use of synchronous communication technology. Various research has reported the success of synchronous communication technology in fostering interaction and collaboration, facilitate brainstorming, and developing a sense of learning community [3].

Aside from enhancing the mechanism of distance learning, the use of synchronous communication technology has been discovered to encourages the students' engagement [4]. Outside of distance education, communication supported by synchronous technology between learners from different countries supports face-to-face lesson aimed to develop multicultural awareness [5].

Literature suggests that the use of synchronous technology so far revolves around certain educational programs that needs to connect people separated by distances or certain subjects that requires exchange of different languages or culture, such as social sciences or EFL. However, very little exploration has been made on the possibility of synchronous technology to enhance the learning of other subjects, such as science or mathematics.



The feeling of being connected and belonging to one community is also one of the focal points of global citizenship. As opposed to a more legal definition of citizenship, global citizenship leans more toward a holistic sense of belonging to a broader community and common humanity, which enables oneself to relate to others of different cultural or national background, based on universal values [6]. From cognitive perspective, being a global citizen means to “acquire knowledge, understanding, and critical thinking global, regional, national and local issues and the interconnectedness and interdependency of different countries and populations” [6].

Global citizenship is characterized by the awareness and concern for global issues as well as the ability to communicate and collaborate to resolve these issues [7]. Education on global citizenship emphasizes on nurturing students as the future agents of change in society through the exchange of information and experience. This can be achieved through the use of global issue as context in learning, communication between students of different cultural and national background, as well as technology that makes this communication possible. Global citizenship education can take curricular or extracurricular approach. With curricular approach, it can be as a standalone subject or embedded in other subjects. However, the subjects in which global citizenship is embedded are usually civic, ethics, or social sciences [7].

Considering the prevalence of data in information nowadays, coupled with the inherence of global issues in global citizenship education, we feel like there is unexplored potential in the subjects that provide platform for exploring and investigating data, such as statistics. Hence, we envisioned an innovative statistics lesson in school designed to foster the students’ global citizenship. We proposed to achieve this through the use of real-life data, global issues as a context, and communication between students of different cultural and national background through synchronous communication technology.

2. Project Detail

The study was conducted as part of APEC lesson study project initiated by Tsukuba University and Khon Kaen University. Started in 2006, one of the goals is to develop collaborative network on lesson study among member economies and use lesson study to develop innovative teaching practices in Mathematics. Over the years, this project has focused on multiple agendas and produced various output, including textbooks and joint conference. The latest one being cross-border lesson study, conducted by pairings of the member economies. Indonesia was assigned with Thailand, which started the collaboration between the representatives from both countries to develop and implement lesson together.

The lesson itself consists of two meetings, each last for 50 minutes. The first meeting was conducted separately in each country, while the second meeting was connected via WebEx. The topics for the first and second meeting are electricity consumption and relationship between electricity consumption and CO₂ emission, respectively. The data are taken from APEC energy database; a database storing energy-related data from APEC member countries and economies. The mathematics objectives of both lessons are for the students to represent, describe, and analyze data, as well as to use the information they acquired from the data in their argument while communicating with students from different national and cultural background.

We conducted the lesson in a secondary school in Indonesia and Thailand, led by one model teacher from each country. There were 32 eighth grade English-speaking students participating in this lesson, each from Indonesia and Thailand. The synchronous communication software used for this lesson is WebEx, a video-conferencing platform. Data are collected in the form of video recording and the students’ written work.

3. Project Implementation

In the first meeting, the topic of discussion is electricity consumption. The objectives of the lesson are for the students to represent data in the form of a graph, describe it, and explain the graph in the context of energy. We gave the students, both in Indonesia and Thailand, a dataset containing total electricity consumption of their own country from 1980 to 2014. The students had to represent the data in the form

of a line graph and describe it. By looking at the graph, the students argued that Indonesia and Thailand have similar increasing trend in electricity consumption.

Critical thinking is part of the global citizenship pedagogy [6], hence this element is incorporated into the lesson through thought-provoking questions. We conjectured that the students might have preconceived ideas that electricity consumption of a country is in direct proportion with its population count. In order to challenge this idea, we gave the students a second graph, showing population count of Indonesia and Thailand. The population graph shows that Indonesian population is far above Thailand. Through comparing the graph of electricity consumption to the graph of population, the students reflected on their assumptions and discussed other possible factors that might contribute to the electricity consumption. In the end, they concluded that increase in electricity consumption is more affected by individual use rather than the number of people living in the country, which led to the discussion about the importance of using electricity wisely.

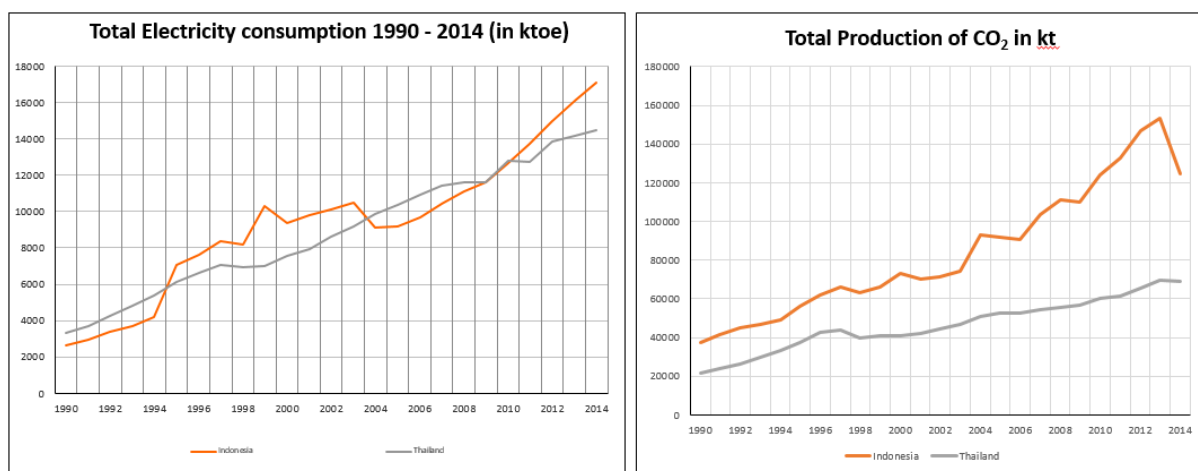


Figure 1. Electricity consumption data and CO₂ emission data of Indonesia and Thailand

Thought-provoking prompt was also incorporated as the 'hook' to trigger meaningful discussion in the second meeting. We showed the students the electricity consumption data and CO₂ emission data of Indonesia and Thailand (Figure 1). At a glance, both line graphs showed similar trends, which shows possible correlation between electricity consumption and CO₂ emission. The teachers brought this to the students' attention, because considering their prior knowledge, the students commonly do not associate electricity consumption to rising carbon footprint.

In order to investigate this phenomenon, the students had to investigate four graphs, namely electricity consumption, CO₂ emission, source of energy to create electricity, and coal consumption. We also include two more countries, USA and China, with the consideration that extreme cases will make it easier for the students to see trends in the data. The graphs show that while electricity consumption of the four countries keeps rising over the decades, the carbon emission of USA gradually level off. The students connected this to other trends they see on the other two graphs, which revealed that USA uses more renewable energy source (nuclear) than the other three countries.

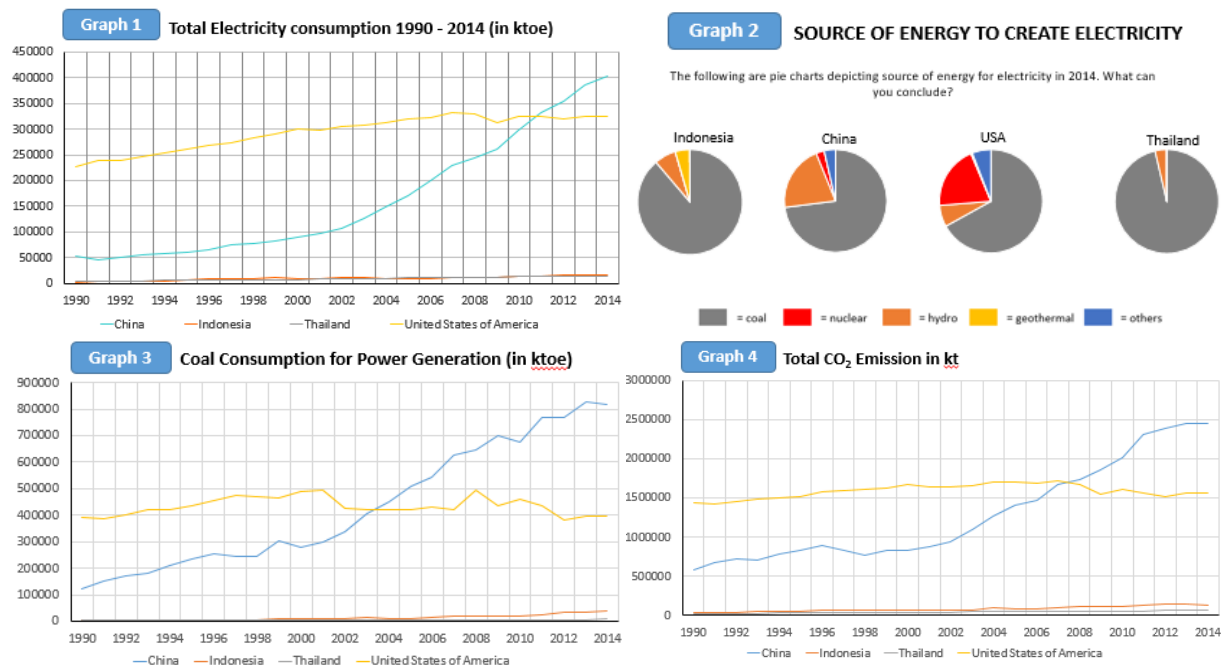


Figure 2. Energy related data from USA, China, Thailand, and Indonesia

In this meeting, they exchanged opinions and discussed their answers with their friends from abroad. The students first discussed their argument in groups, before representatives from each group presented their answer in front of the class. The students then engaged in question and answer session, sharing their arguments and listening to feedbacks from their friends. In the end, the students concluded that the lurking variable behind what seems like the correlation between electricity consumption and carbon emission is the source of energy to generate electricity.

4. Findings

There are a few things emerging during the implementation of this study that are worth of discussion. Firstly, the students were engaged in the issue. Young students tend to have difficulty in seeing how global issues related to their life, which can contribute to lack of awareness and ignorance. The use of contextual problem in Mathematics and Statistics is not new, however teachers usually prefer contexts that is close to students' life and can be imagined easily. By using global issues as context and providing the opportunity for the students to discuss this problem with fellow students abroad, the students can see that these issues are not only fancy political agenda, but real problems that are the concern of real people around the world.

Below are some examples of the students' answers.

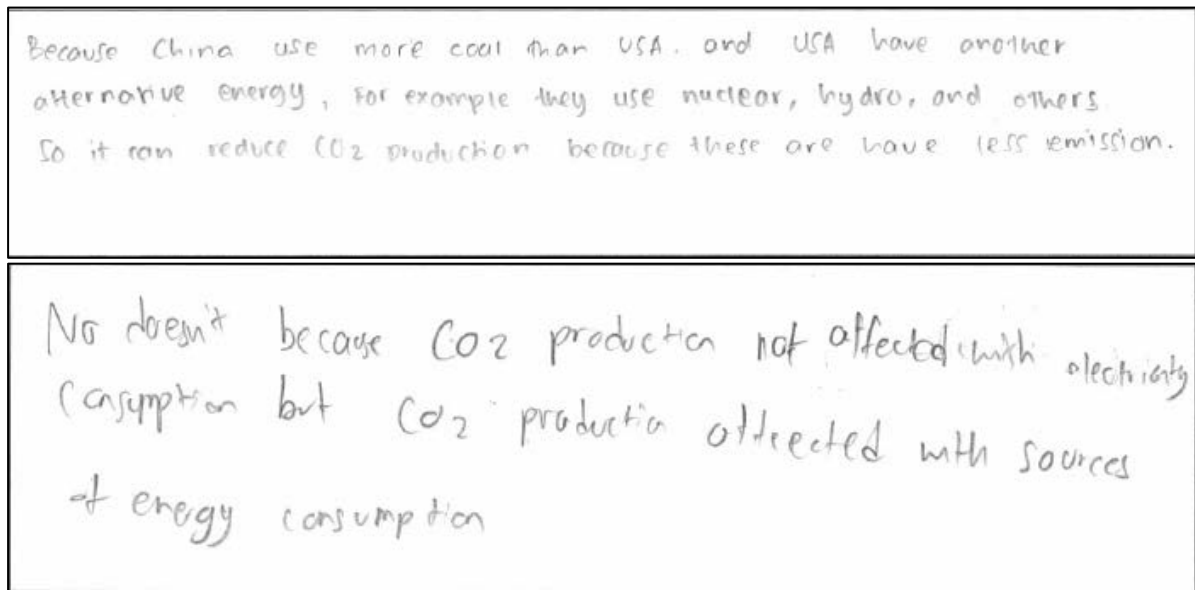


Figure 3. The example of the students' answer

Secondly, the students can participate in discussion with people from different cultural and national background. Energy is an issue that transcends cultural and geopolitical boundaries; everyone is affected by it regardless of their race, religion, or nationality. Such carefully chosen context, together with the ability to discuss it with people who share the same concern, provide ground for dialogue and collaboration with people of different cultural and national background, which is an essential feature of global citizenship.

Lastly, the students are able to see the relevance of statistics through the use of real-life data in solving problems. One Indonesian students stated that, "This lesson is different than usual statistics lesson because we use valid data about global issue". In the group discussion before and during the use of synchronous communication technology, they critically think and share what they have found to tackle the given problems. In this discussion, synchronous communication technology has important role in facilitating students to construct ideas in multiple perspectives, at least from the perspectives of their fellow students in different country and culture.

Despite the useful insight in using synchronous communication technology to enhance statistics lesson, we also acknowledge some rooms for improvement from technical perspectives. In implementing such technology, we recommend good internet connection, clear input and output audio, and maximizing WebEx whiteboard feature. This feature makes it possible to share whiteboard beside the camera display. This way, the camera does not have to switch back and forth between the students and the whiteboard. Shall teachers prefer to use other synchronous communication software; we recommend those with similar features.

5. Conclusions

In this study, we have use synchronous communication technology for interactive learning, beginning with the real problems situation accessible by students in both countries. After they solved the problem, the students presented their ideas were presented and discussed it with their fellow students. In the second part, the teacher posed new question for students to consider and to provide their reasoning at the same time, in which they have to refer to their ideas in the first part of the lesson. This means that students can learn together even with different local language.

Synchronous communication technology can support statistics lesson in promoting global citizenship through facilitating discussion on global issue between students from different countries. Global issues can be meaningful contexts for the students if they are provided chance to discuss it with people their age who share the same concern on the issue. Discussion with students from different countries also open possibilities for dialogue and collaboration with people of other cultural and national background. Furthermore, it also strengthens the relevance of real-life data in solving global issues through sharing solutions and exchanging ideas. Real-life data has been increasingly recommended in statistics education due to making learning activity a complex, rich, and challenging one [8], as well as providing ground for students to grapple with statistical techniques used in real life [9]. By incorporating real-life data in statistics tasks and providing grounds for students to exchange ideas with people from different countries, the students can see how statistics can help them understand worthy and significant issues in the world.

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