

The 12th APEC-Khon Kaen International Symposium:
Innovation of Mathematics Education through Lesson Study Textbook Development for SDGs, STEM, and Energy by Cross-border Education
9-12 September 2017
and The 10th International Conference on Educational Research: *Challenging Education for Future Change*
9-10 September 2017
Faculty of Education, Khon Kaen University, Khon Kaen, Thailand

Proposed Plan between Malaysia_SEAMEO RECSAM @ Philippines_UPNISMED

1. Theme of the lesson study for mathematics:

- Imagine hidden variables and relations by asking questions based on information presented in graphs and appreciate the significance of being able to analyse situations and predict the future by using them.

2 Task Design:

- It aims to familiarize the students with the primary energy supply (oil) which includes indigenous production and importation as well as the consumption of primary energy (oil), of the two countries.
- Students may ask questions by applying their mathematical and statistical knowledge and skills to compare the two countries on the above-mentioned aspects.
- In the second task, the students are supposed to infer some factors (hidden variables) that may provide explanation for the differences of the two countries in terms of their oil consumption. It involves Graphs which show the possible role of population, currency exchange rate, and primary energy resources of a country in its use of oil.
- Both tasks cover the goal of sustaining development by reducing the population growth rate, wise use of resources, and developing other local sources of energy to minimize dependence on imported oil.
- Refer to the Homework for Graphs 1, 2, 3, and 4 and to the Worksheet for Graphs 5, 6, 7, 8, and 9.

3 Class Objectives

- communicate and exchange ideas with fellow students from another country
- apply their knowledge and skills on average, percent, and graph interpretation
- use information drawn from graphs to identify factors such as population, economy, and energy resources to explain the differences in the energy consumption, particularly oil, of two countries
- think mathematically and appreciate the influence of different factors (hidden variables) related to sustainable development

4 Grade Level: Grade 5 (Philippines) and Grade 7 (Malaysia)

5 Preparations:

- Before giving the Homework, the teacher will first discuss to the class important terms that will be used in the lesson, namely: primary energy supply, secondary energy supply, indigenous production, import, kilo tons of oil equivalent (KTOE), consumption, population, per capita, and exchange rate. The concept of variable and specifically hidden variable is not yet introduced in Grade 5. So for the purpose of this lesson, it may suffice to refer to hidden variables as possible factors.

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HOMework

Possible HOMEWORK questions:

The Filipino teacher will ask the Filipino students to pose questions:

Examples:

From 1999 until 2005, Malaysia's primary energy supply based on oil was increasing (Graph 1). What was the average increase in the supply?

In the same period, the primary energy supply based on oil of the Philippines was decreasing (Graph 1). What was the average decrease in the supply?

- What was the percent increase in the amount of primary energy based on oil that was consumed by Malaysia in the years 1994 and 2014 (Graph 4)? How about for the Philippines (Graph 4)?
- Both classes solve and share their answers.

- The Malaysian teacher will ask the Malaysian students to pose questions:
Examples:
 - How many percent higher was the indigenous production of oil by Malaysia compared with that by the Philippines in 2004 (Graph 2)?
 - What is the difference in the highest and lowest amounts of oil imported by Malaysia and the highest and lowest amounts of oil imported by the Philippines (Graph 3)?
 - Both classes solve and share their answers.

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Worksheet

(during the lesson/discussion)

Possible questions during the class discussion

***Task 1** : First, the Malaysian teacher will ask the students of both classes to study the graph. The students should be able to observe from Graph 5 that although the population of each country was increasing yearly from 1994 to 2014, their population growth rate was decreasing. The teacher will ask: If the total primary energy consumption (oil) per capita of each country is graphed, how will the two graphs appear in relation to each other?

The students should be able to explain that Malaysia uses more total primary energy based on oil than the Philippines. Moreover, it has a smaller population than the Philippines. (Graph 6). Thus, its total primary energy consumption based on oil per capita is bigger than that of the Philippines for 1994 to 2014. So the graph for Malaysia will be above the graph for the Philippines.

- **Task 2**, the Filipino teacher will show the graph of the exchange rate of the Malaysian ringgit and the Philippine peso to one US dollar (Graph 7). He/she will ask how the amount of Oil imported from other countries and the exchange rate of the currencies of the two countries to a US dollar may relate with the differences in their total primary energy consumption based on oil. The students should be able to explain that the value of the Philippine peso in relation to a US dollar is much smaller than that of the Malaysian ringgit to a US dollar.

- **Task 3**, the Malaysian teacher will ask the students of both classes what the different sources of primary energy are in their country and ask them to study the two graphs (Graph 8 on the Philippines and Graph 9 on Malaysia). The students should be able to observe that in the Philippines, oil is the main primary energy source. Over the years, the other four sources namely, geothermal, others, coal, and natural gas are at least contributing more or less the same amount annually or increasing substantially in their annual contribution to the overall primary energy supply. And possibly because of this, among others, the total primary energy consumption based on oil is not that much.
- The students should also be able to observe that in Malaysia, apparently, oil and natural gas are the main sources of primary energy. Coal has some substantial contributions, too, while the rest relatively, have only little contributions. Again possibly because of this, among others, the total primary energy consumption based on oil is bigger in Malaysia than in the Philippines.

***Task 4:** Write what you have learned in this lesson.

- In summarizing the important ideas covered in the lesson these include those that pertain to the goal of sustaining the development of the two countries such as reducing the population growth rate, wise use of resources, and developing other local sources of energy to minimize dependence on imported oil.

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Terima Kasih

Maraming salamat po!!