

**INNOVATION OF MATHEMATICS EDUCATION THROUGH LESSON STUDY:
CHALLENGES TO ENERGY EFFICIENCY ON STEM AND CROSS BORDER EDUCATION**

Schools: Penang Free School (Penang, Malaysia)
University of the Philippines Integrated School (Manila, Philippines)

Topic: Energy Efficiency

Duration: 40-60 minutes

Grade Level: 7 in Malaysia, 5 in Philippines

Number of Students: 18 in Malaysia, 32 in Philippines

Lesson Objectives:

During the lesson, the learners will:

1. communicate and exchange ideas with fellow students from another country.
2. apply their knowledge and skills in currency conversion, graph interpretation, and average.
3. identify the different sources of energy and ways on how to efficiently conserve energy.

Materials:

- Electric bills of a typical household in Malaysia and in Philippines
- Graphs of a year-round electric bill consumption of a typical household in Malaysia and in Philippines

Demonstration Teachers:

<p>Malaysian Team Ms. Teoh Bee Yan Ms. Linda Toh Mr. Pedro I. Montecillo Jr. Mr. Julito C. Aligaen Dr. Nur Jahan Ahmad</p>	<p>Philippine Team Ms. Lady Angela M. Rocena Dr. Soledad Ulep Dr. Aida Yap Mr. Guillermo Bautista Jr.</p>
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Lesson Outline:

Activity	Philippines' Role	Malaysia's Role
Introduction	<p>Teacher Angel to Filipino students: <i>"Good morning class! Today is special because we will be learning about energy with teachers and students from Malaysia."</i></p> <p>Teacher Angel to Malaysia: <i>"I am Teacher Angel and with me are the Grade 5 students from the University of the Philippines Integrated School."</i></p> <p>Filipino students greet Malaysian teachers and students.</p>	

		<p>Teacher Teoh introduces herself and the students.</p> <p>Malaysian students greet Filipino teachers and students.</p>
<p>Discussion 1 CURRENCY CONVERSION and SOURCES OF ENERGY</p>	<p>Teacher Angel writes the responses on the board.</p> <p>Teacher Angel to Filipino students: <i>“Are there other common information that you notice?”</i></p> <p>2 Filipino students respond.</p> <p>Teacher Angel writes the responses on the board.</p> <p>Teacher Angel to Filipino students: <i>“Do you also notice the differences between the two electric bills? Give the most obvious difference that you see.”</i></p> <p>1 Filipino student responds.</p> <p>Teacher Angel writes the response on the board.</p>	<p>Teacher Teoh to all students: <i>“Yesterday, you were given copies of electric bills from Malaysia and the Philippines and you were asked to write questions about them. Before we proceed with the questions, let’s first take note of the information found in the electric bills.”</i></p> <p>Teacher Teoh to Malaysian students: <i>“What common information can you see in the electric bills?”</i></p> <p>2 Malaysian students respond while Teacher Teoh writes the responses on the board.</p> <p>Teacher Teoh writes the responses on the board.</p> <p>Teacher Teoh writes the response on the board.</p> <p>Teacher Teoh to Malaysian students: <i>“What other striking difference do you notice?”</i></p> <p>1 Malaysian student responds.</p>

<p>Teacher Angel writes the response on the board.</p> <p>Filipino students respond.</p> <p>Filipino students ask questions while Teacher Angel posts the questions on the board.</p> <p>Teacher Angel to all students: <i>“Now we know that the rate of electricity in Malaysia is 0.218 RM while the rate of electricity in Philippines is Php 8.79.”</i></p> <p>Teacher Angel to Filipino students: <i>“What do we need to do if we want to compare the two rates?”</i></p> <p>1 Filipino student responds. (Expected answer: Convert the rates to the same currency.)</p> <p>Teacher Angel to all students: <i>“Let us convert the rates to the same currency so that we can compare them later. Filipino students will convert the Malaysian rate to peso while</i></p>	<p>Teacher Teoh writes the response on the board.</p> <p>Teacher Teoh to all students: <i>“Now you may ask the questions that you prepared.”</i></p> <p>Teacher Teoh to Malaysian students: <i>“What would you like to ask your Filipino friends about the electric bills?”</i></p> <p>1-2 Malaysian students ask questions while Teacher Teoh posts the questions on the board.</p> <p>Malaysian students respond.</p> <p>If not asked, Teacher Teoh will lead the Malaysian students to <u>ask about the rate per kWh in the Philippines</u> (since it is not explicitly written on the Philippine electric bill).</p>
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Malaysian students will convert the Philippine rate to ringgit. Use the exchange rate, 1 RM = Php 11.69."

Teacher Angel writes the conversion factor on the board.

1 Filipino student writes his/her solution on the board while the rest of the class solves in their notebooks.

Filipino student explains how he/she converted the ringgit to peso.

Teacher Angel writes the converted rates on the board.

Teacher Angel to Filipino students:
"Did you have the same observation?"

Filipino students respond. (Expected answer: Yes.)

Teacher Angel to Filipino students:
"What would you like to ask your Malaysian friends about your observation that their electricity is cheaper than ours?"

1-2 Filipino students ask questions while **Teacher Angel** posts the questions on the board.

Teacher Teoh writes the conversion factor on the board.

1 Malaysian student writes his/her solution on the board while the rest of the class solves in their notebooks.

Malaysian student explains how he/she converted the peso to ringgit.

Teacher Teoh writes the converted rates on the board.

Teacher Teoh to Malaysian students:
"Now compare the rates per kWh of the two countries."

Malaysian student responds. (Expected answer: The rate per kWh in Malaysia is much cheaper than the rate in the Philippines.)

Malaysian students respond.

	<p>Filipino students respond.</p> <p>If not asked, Teacher Angel will lead the Filipino students to <u>ask about the sources of energy in Malaysia</u> (because it might be one of the reasons why their electricity is cheaper).</p>	<p>1-2 Malaysian students ask questions while Teacher Teoh posts the questions on the board.</p>
<p>Discussion 2: GRAPH INTERPRETATION</p>	<p>Teacher Angel to all students: <i>“So far, we have discussed about the sources of energy from Malaysia and Philippines. Now let’s focus on how we consume energy by observing the electric consumption graphs from January to July.”</i></p> <p>Teacher Angel to Filipino students: <i>“Describe the electric consumption graph of Malaysia.”</i></p> <p>2-3 Filipino students respond. (Expected answers: range of energy consumption, month with highest energy consumption, month with lowest energy consumption)</p>	<p>Teacher Teoh to Malaysian students: <i>“Describe the electric consumption graph of Philippines.”</i></p> <p>2-3 Malaysian students respond. (Expected answers: range of energy consumption, month with highest energy consumption, month with lowest energy consumption)</p> <p>Teacher Teoh to Malaysian students: <i>“What would you like to ask your Filipino friends about the graph?”</i></p> <p>1-2 Malaysian students ask questions while Teacher Teoh posts the questions on the board.</p>

	<p>Filipino students respond.</p> <p>1-2 Filipino students ask questions while Teacher Angel posts the questions on the board.</p>	<p>Malaysian students respond.</p>
<p>Discussion 3: AVERAGE and WAYS TO CONSERVE ENERGY</p>	<p>1 Filipino student writes his/her solution on the board.</p> <p>Filipino student explains how he/she solved for the average electric consumption of Malaysia.</p> <p>Teacher Angel writes on the board the average consumption of both households.</p>	<p>Teacher Teoh to all students: <i>“Now we would like to compare the energy consumption in Malaysia and Philippines.”</i></p> <p>Teacher Teoh to Malaysian students: <i>“We need one value that would represent the energy consumption from January to July. What value are we looking for?”</i></p> <p>1 Malaysian student responds. (Expected answer: Average of energy consumption from January to July.)</p> <p>Teacher Teoh to all students: <i>“Let us solve for the average energy consumption from January to July of Malaysia and the Philippines so that we can compare them later. Malaysian students will solve for the average in the Philippines while Filipino students will solve for the average in Malaysia.”</i></p> <p>1 Malaysian student writes his/her solution on the board.</p> <p>Malaysian student explains how he/she solved for the average electric consumption of Philippines.</p> <p>Teacher Teoh writes on the board the average consumption of both households.</p>

	<p>Teacher Angel to Filipino students: <i>“Now compare the average energy consumption in Malaysia and Philippines.”</i></p> <p>1 Filipino student responds. (Expected answer: The Malaysian household generally consumes more energy than the Philippine household.)</p> <p>Filipino students respond.</p> <p>1-2 Filipino students ask questions while Teacher Angel posts the questions on the board.</p>	<p>Teacher Teoh to Malaysian students: <i>“Do you agree with their observation?”</i></p> <p>Malaysian students respond. (Expected answer: Yes.)</p> <p>Teacher Teoh to Malaysian students: <i>“What would you like to ask your Filipino friends about this comparison that the Malaysian household consumes a lot more energy than the Filipino household?”</i></p> <p>1-2 Malaysian students ask questions while Teacher Teoh posts the questions on the board.</p> <p>Malaysian students respond.</p> <p>If not asked, Teacher Teoh leads the Malaysian students to <u>ask how Filipinos save energy</u> (since they consume much less energy based on the graphs).</p>
<p>Conclusion</p>	<p>Teacher Angel to all students: <i>“Now it’s time to summarize what we have learned from each other.”</i></p> <p>Teacher Angel to Filipino students: <i>“What did you learn from your Malaysian friends today?”</i></p>	

	<p>1 Filipino student shares what he/she learned from the discussions.</p>	<p>Teacher Teoh to Malaysian students: <i>“What did you learn from your Filipino friends today?”</i></p> <p>1 Malaysian student shares what he/she learned from the discussions.</p>
<p>Closing</p>	<p>Filipino students say goodbye to Malaysian teachers and students.</p>	<p>Malaysian students say goodbye to Filipino teachers and students.</p>