



Bio Energy Literacy: Assessment Tool Creation

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Introduction

The NARA Education Team has spent the last two years examining, defining, and developing an assessment strategy for participants in K-Teacher educational programming. Over the past several years many lessons, workshops, and energy-based learning opportunities have been offered for a wide audience in the Pacific Northwest. The NARA Education Team aims to increase energy literacy of students and adults, thus the need for creating a tool to quantify change in energy literacy as a result of NARA related education and to understand current gaps in energy concepts.

Defining Energy Literacy and Science Identity

The Department of Energy created the Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education (2013). Energy literacy, as defined by DOE, "is an understanding of nature and role of energy in the universe and in our lives" and "energy literacy is also the ability to apply this understanding to answer questions and solve problems." The framework created by DOE, breaks down energy concepts into seven principles that hope to empower individuals and communities to make informed energy decisions.

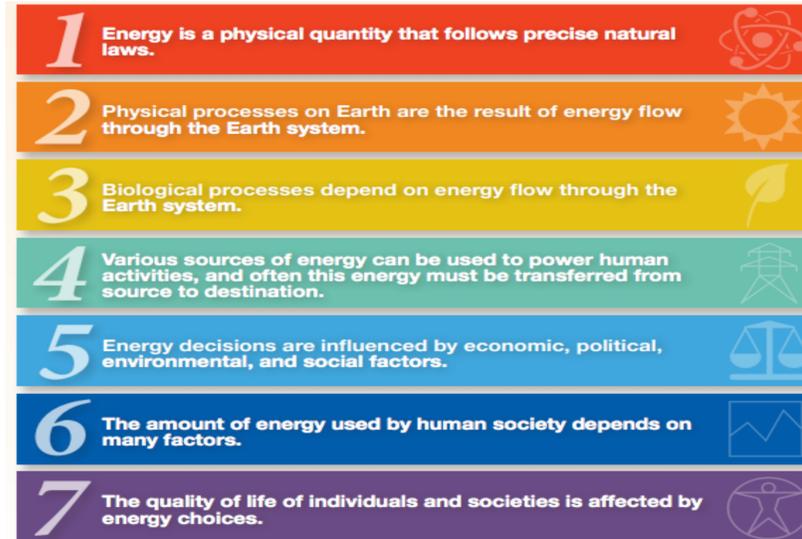
Science identity refers to the ability for a person to think of themselves as a science learner and someone who can or does know about science, uses science and contributes to science. Strong science identity is often developed through the development of skills that are then practiced and cultivated and the recognition that comes from the performance of the skills. Students that have strong science identity have are more likely to enroll in science related classes, pursue science related careers and persistent in these careers. Science identity is determined by using a Likert-like scale ranging from Strongly Agree (5) to Strongly Disagree (1).

Methods

With the foundation of the DOE Energy Literacy document and guidance from WSU's Chad Gotch, the Education Team created assessment questions using a multiple-choice format for students. The NARA Education Team went through many iterations and to create questions that evaluated basic energy knowledge and understanding but also incorporated elements of biofuel education specifically. Currently two versions of the assessment have been created: high school and middle school.



DOE Energy Literacy Principles



Fall 2014 Sample Surveyed

About 2500 students participate in our MOSS residential program a year. A sampling of the fall population of students (n= 304) participated in pretest, posttest, one-month delayed posttest assessment. Students completed the pretest the first day of the program and the posttest the final day of the program. The one-month posttest was mailed to schools following their visit to MOSS. All three tests are identical with each other. The tests contained questions relating to science identity and to energy literacy as defined by the US Department of Energy.

Results

The results from fall 2014 assessment indicates that students that attending a four or five-day MOSS residential program demonstrated a positive increase in their science identity and energy literacy, overall. Although there was a decrease in science identity between the posttest and one-month posttest, there remained an overall positive increase in science identity between the pretest and one-month posttest. Energy literacy increased between each testing time. MOSS programming resulted in students' increase in identifying with science and increase in energy literacy content knowledge. Current MOSS program is a positive influence on students' development of their science identity and development of their competence in energy literacy.

The mean Energy literacy pretest was 6.70 (*sd* = 2.72); the mean Energy literacy posttest was 7.50 (*sd* = 2.71); the mean Energy literacy one-month posttest was 8.12 (*sd* = 2.98). A significant increase from pretest to posttest was found ($t(304) = 5.19, p < .000$); a significant decrease from posttest to one-month posttest was found ($t(304) = 3.75, p < .000$); a significant increase from pretest to final was found ($t(304) = 8.25, p < .000$).



Spring 2015 Sample Surveyed

In the spring of 2015 students attending the MOSS residential program completed the middle school NARA Energy Literacy tool (n=508). Item total correlation is low (majority of questions are less than 0.3 correlation with the total Energy Literacy score). Energy Literacy Scores (total)

Mean	Median	Mode	Std deviation	Std error	Cronbach's alpha
10.86	11.0	11.0	3.01	0.135	0.473

Question #	% correct	Question #	% correct	Question #	% correct
EL1	43.9	EL9	29.5	EL16	44.91
EL2	54.3	EL10	82.3	EL17	13.4
EL3	29.9	EL11	72.2	EL18	52.4
EL4	67.1	EL12	46.1	EL19	36.2
EL5	45.1	EL13	70.7	EL20	51
EL6	64.2	EL14	46.3	EL21	52
EL7	61.2	EL15	38	EL22	33.3
EL8	50			Average % Correct	52.24

Next Steps:

- Evaluate questions commonly missed
- Develop and implement lessons to target commonly missed questions
- Create an assessment tool for elementary school students
- Pilot test elementary test

References:
United States Department of Energy. (2013) Energy literacy: Essential Principles and Fundamental Concepts for Energy Education.

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