Biggest Energy Loser Challenge: Energy Efficient Building Technology Curriculum Development
Final Report

Oakridge National Laboratory (ORNL) utilizing staff expertise from its Department of Energy designated National User Facility, the Building Technologies Research and integration center (BTRIC) assisted Southern University, a participant in the ORNL Mentor Protégé Program to develop an energy curriculum. Southern University was requested to assist in the development an online (or real time video) course for middle school students from Japan and Hawaii on energy efficient building technologies. The tasks consisted of three sessions covering topics in the following areas: building envelopes, heating and cooling equipment, lighting, appliances, renewables, and energy conservation.

Description of Deliverables

Southern University was pleased to support Oakridge National Laboratory in the development of online (with real time video) course for middle school students from Japan and Hawaii on energy efficient building technologies. The participating teachers and schools were 1) Mr. Gentry Hirohata of Punahou Middle School, Honolulu, Hawaii; 2) Ms. Rika Heshiki of University of the Ryukyus Junior High, Okinawa, Japan; 3) Ms. Tara Hollins of Southern University Laboratory School, Baton Rouge, Louisiana. The topic for the curriculum was centered on the "Biggest Energy Loser Challenge." It consisted of three sessions and the content of each session was linked to standards of each school district or Ministry of Education. The sessions were presented in two-30 minute online classes developed by Oak Ridge National Laboratory (Mrs. Melissa Lapsa and Mr. Roderick Jackson) and Southern University and A&M College (Dr. Samuel Washington, Dr. Francesca M. Mellieon-Williams, Mr. Jason Lockhart and Mr. Jin Lee). The curriculum was presented to teachers for their feedback throughout its development. The final curriculum was uploaded to a digital dropbox folder with assessments.

The first class involved energy saving technologies (using viewgraphs) such as solar, thermal, radiant, motion, sound and electrical energy. From these technologies students discussed the types of energy used in the building envelope, heating, ventilation, air conditioning, lighting, and appliances. The first session was presented February 13-17, 2012. Each student/group was assigned to complete a home energy survey following this session. Additional activities using online websites including website scavenger hunt and Google-Sketch UP Activity were assigned. The students from the three middle schools communicated via Edmodo.com throughout the sessions.

The second session focused on in home energy efficient equipment-daylighting, windows and glass, shading devices, energy efficient lighting, programmable thermostats, insulation. This session also detailed differences between US, Hawaii and Japan. Each class was divided into groups and were responsible for designing an energy efficient home using Google Sketch-Up. The groups were judged for the most energy efficient home which is where the name the Biggest Energy Loser Challenge was derived.

The final session was LIVE with all schools meeting virtually for the first time via Skype. The winners from each class were announced during this session. The winners for the first Biggest Energy Loser Challenge are: Punahou Middle School-Group 5; University of the Ryukyus Junior High-Red Bull; Southern University Laboratory School-The Little Giants. Later the students asked questions about the project and daily life in the different areas.

An exit survey was developed for teachers to evaluate the curriculum. The survey was administered via Survey Monkey and responses recorded (See Figure 1).

Figure 1. Biggest Energy Loser Challenge Curriculum Exit Survey for Teachers.

1. Content			
	Agree (1)	**Not Sure (2)**	**Disagree (3)**
How appropriate is the content for the designated age level?			
How significant and relevant to the students' daily lives is the content?			
Provide evidence for each question and recommendations.:			
2. Rate the instructional design of the curriculum.			
	Agree (1)	**Not Sure (2)**	**Disagree (3)**
Is scientific investigation taught, modeled and practiced where appropriate?			
Do the materials actively engage the students to promote their understanding of the content?			
Are there sufficient experiences and opportunities for discussion for students to develop deep understanding of content?			
Provide evidence of each question and other recommendations.:			
3. Organization of teacher's Materials			
	Agree (1)	**Not Sure (2)**	**Disagree (3)**
Do the teacher materials include clear and adequate background information?			
Are there clear and adequate guidelines to support teaching all aspects of the lessons?			
Are the format and structure of the teacher materials easy for a teacher to follow?			
Please provide evidence for each question and any recommendations about teacher's materials.:			
4. Are there any special facilities or equipment needed to implement program? Any recommendations for additions to current facilities or equipment?			
5. Assessment			
	Agree (1)	**Not Sure (2)**	**Disagree (3)**
Are assessments for both students and teachers included in the materials?			
Is there a variety of formal and informal assessments?			
Please provide evidence and recommendations for assessments.:			
6. Did you develop any assessments for your students? If yes, Please load to the dropbox folder.			
7. Equity			
	Agree (1)	**Not Sure (2)**	**Disagree (3)**
Is the material free of racial, ethnic, gender and age bias?			
Are appropriate strategies included to meet the needs of special/diverse populations?			
Please provide evidence for each question and recommendations.:			
8. Alignment with Standards			
	Direct Alignment (1)	**Somewhat Aligned (2)**	**Not Aligned (3)**
How does the content align with national, district, and state standards and frameworks for scientific knowledge?			
How does the content align with national, district, and state standards and frameworks science thinking skills?			
How does the content align with national, district, and state standards and frameworks across the curriculum?			
Please provide evidence for each questions and recommendations.:			
9. Please include any recommendations to the curriculum for future teachers and students.			
10. Describe demographics of your classroom and/or after school groups that participated in the Challenge.			
Total Number of Students			
Number of Males			
Number of Females			

The survey was revised from The Education Development Center, Inc., Translating Ideas Into Practice, www.edc.org/cse. The goal was to evaluate all aspects of the curriculum to learn how and where changes should be made for the next group. The best knowledge is taken from those who taught the information first hand. The closed-ended and open-ended questions provided two-dimensional answers allowing teachers to share their thoughts and provide examples. All teachers agreed the content was 1) appropriate for the designated age level and 2) significant and relevant to the students' daily lives. The evidence and recommendations varied by school. Some comments include:

- "Our school does a unit on the topics covered. Punahou also has a sustainability initiative which is focused on five areas: Energy, Waste, Water, Food, and Transportation. The energy initiative is especially highlighted in the Biggest Loser Curriculum."
- "My students were very eager to learn more once the curriculum was presented to them. It was a challenge and they truly enjoyed completing the course work. They have continued to talk about the conversations they are having with their parents to make changes so that they can conserve energy and have a more energy efficient home."

- "In science classes and the daily life, students have heard what the types of energy are. The same thing can be said about renewable energy and nonrenewable energy. So the content is appropriate for designated age level. This program focused on domestic design of house, and it reflects climatic condition, culture and values. So students were interested in difference between the two countries about energy situation. This has led to an independent-minded stance of students. I think it is a good step toward solutions to energy problem for young generation."

Two out of three teachers agreed that scientific investigation was taught, modeled and practiced where appropriate. There was also agreement that the materials actively engaged the students to promote their understanding of the content. However, the teachers did not agree that there were sufficient experiences and opportunities for discussion for students to develop deep understanding of content. One teacher did recommend that voice over be more engaging as well as provide a video for students to view and have students chat via Edmodo about the video.

The organization of teacher's materials was found to be favorable with clear and adequate background information, clear and adequate guidelines to support teaching all aspects of the lessons, and the format and structure of the teacher materials were easy to follow. The email communication between the project director and teachers made questions easily answered. The materials should also provide more detail specific content on the geographic location of where the course is being taught. This is important to allow students have an accurate comparison of their area and other regions.

The teachers did have a few request/recommendations for special facilities or equipment that is needed to implement the program:

- Provide samples of solar panels, CFL lights ,etc. energy saving appliances
- School computers need internet access and be able to run support programs (Skype, Sketch-up). Mini-photovoltaic meter to demonstrate how much electricity can be produced. Different types of window materials with a heat lamp to see the effects on reducing solar heating
- Watt Electricity Usage Monitor

These items should be included with preparation for teaching the course. The hands-on component allows students to "see" science at work.

With regards to assessment, there were mixed responses about the inclusion of assessments for teachers and students. One school included the lesson with their existing sustainability curriculum and therefore assessed their students with those activities. It was also added that if the content becomes deeper then the assessment will need to be modified. The overall teacher assessment was interviews and survey.

All teachers agreed the curriculum was not gender biased. However, it was stated that the Google Sketch-up Program did not include ethnic components. "It was difficult to find the components with Japanese students' certain image from Google sketch-up". Also the energy audit should be modified to include familiar home appliances. For example "ceiling fan and window fan are not so popular. Rice cooker and kotatsu are commonly-used. The kotatsu is a Japanese-style warming device." It is recommend that the teachers review the assignments and activities and provide the development group with specifics that may not align with their geographic area.

Overall, the curriculum was found to align to the standards of those schools that use standards for teaching. One school stated

> "This content was in line with Education Ministry guidelines in Japan. Education Ministry guidelines are given as follows. (a) Energy a. Various forms of energy and its conversion To enable students to understand that the conversion of various forms of energy is used in daily life and society through observations and experiments related to energy. b. Energy resources To enable students to understand that people obtain energy from hydraulic power, thermal power, and atomic energy while also recognizing that the efficient use of energy is important. (b) Scientific and technological developments a. Scientific and technological developments To enable students to understand the course of scientific and technological developments and recognize the fact that science and technology enrich human life and make it more convenient and pleasurable. (c) Conservation of the natural environment and the use of science and technology a. Conservation of the natural environment and the use of science and technology To enable students to scientifically consider modalities for conservation of the natural environment and the use of science and technology, while also recognizing that the creation of a sustainable society is essential."

The implications here at that the curriculum is universal and easily adapted for middle schools across the nation. The final recommendations and comments from teachers and students:

- Increase student collaboration; Edmodo was a great tool and will be used in our school for future activities
- Make the presentation more engaging
- Deepen the content requirements
- Provide demo materials
- Provide more time with content, it felt rushed trying to learn Google-Sketch-Up
- Students were excited about the material and did transfer outside the classroom.