Using Simple Lessons to Teach Elementary Students About Energy Literacy, the Environment and Energy with a Wood Residual Biofuel Focus

Jace Hogg *Environmental Science, Junior*

Karla Eitel *Advisor*, NARA SURE, McCall Outdoor Science School

Washington State University

University of Idaho

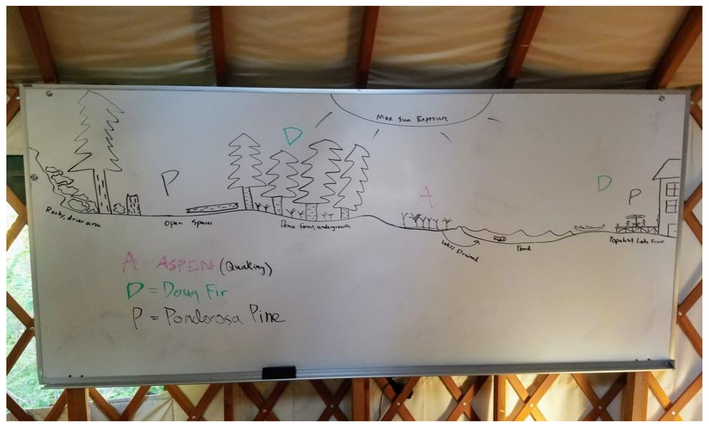

Figure 1: This white board diagram is from Lesson II: 'The Tree Knows Best!'. Students choose which habitat where one of three tree species would grow best, then discover that where they 'grow best' is where they absorb the most energy that gets stored and explained in more detail in Lesson III.

Introduction

Beginning energy literacy at a young age is becoming increasingly more important as new and exciting technologies develop. Such technologies include ones developed from programs like NARA (Northwest Advanced Renewables Alliance), were we can now create environmentally conscious alternatives to jet fuel made from woody biomass.

Since future generations will soon be in charge of our energy resources, researchers at the U of I MOSS campus have started developing lesson plans that provide students ages 6-11 a base understanding of what energy is, so coupled with future energy learning initiatives, they can eventually make well informed decisions about energy use.

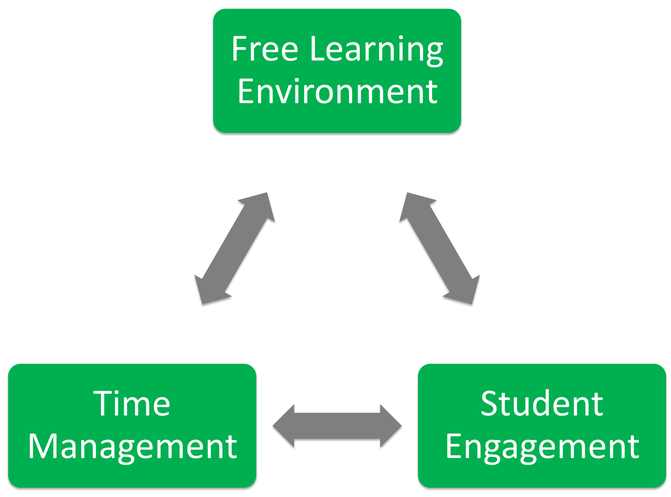

Figure 2: This flow-chart illustrates the importance of making a lesson plan that keeps these three important principles in check. Without this balance, it becomes increasingly more difficult to teach the lesson or concept.

Methods

In order to begin the process off designing a lesson plan, researchers needed to establish **two** main idea from students:

- **What do they know about energy?** Four questions were prepared for students to answer to gain insight to what they know: What is energy? How do we use energy? Where does energy come from? How do you like to learn? This provided a baseline of knowledge to work from moving forward.

- **How does teaching at Adventure Day Camp actually work?** It is difficult to create a lesson plan or curriculum without first understanding the learning environment in which one is teaching in. By design, ADC is a *free learning environment*, which means students are under no obligation to learn, and there are no real consequences for not learning. Experiencing this, researchers needed to keep in mind a balance of concepts seen in to the left **Figure 2**.

After taking 2-3 weeks to establish these two ideas, researchers took different approaches to engage and educate students. One way was by **creating a series of three mini lessons:**

Lesson I: Lego My Energetics! is an interactive activity where students learn the first basic principle of thermodynamics through the manipulation of Legos.

Lesson II: The Tree Knows Best! is a two-part interactive lesson where students learn about three major tree types in the Pacific Northwest in an outdoor activity, then explore how those grow best, or absorb energy the best, in an indoor whiteboard drawing exercise.

Lesson III: Whose Tree Is It Anyway? is an outdoor guided learning experience where students learn what fossil fuels are, how they are made, then what the concept of a renewable energy is, how trees can fit into that role, and the uses of that idea in the form of biofuels.

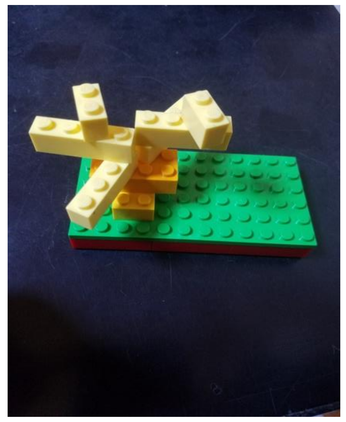

Figure 3: The three pictures above show different stages of the small world Lego demonstration in Lesson III: 'Whose Tree Is It Anyway?'
Here, the instructor explains how the yellow Legos represent stored energy in a tree, and the process of how it changes form and can end up in the ground as fossil fuels. Conversely, the instructor shows how humans can leave energy in the ground and reuse the trees as a renewable resource by rearranging the yellow Legos on top of the green plate, and leaving the other yellow ones 'underground' to represent fossil fuels.

Results

Lessons I,II, and III were tested 3 times each, the oldest student being 11 years old, and the youngest that were tested was 5 years old. After each lesson, there were a series of follow up questions that would show, based on student responses, if they can now explain the learning objectives laid out before the lesson.

No quantitative data was collected, circumstances did not allow it, but **qualitative data** showed that:

- The lessons were a **success**. Positive feedback was gained from all 9 trials of the lessons, and some students would start to say 'look, he has Legos, we are talking about energy.'

Discussion

Figure 4: Below are two ADC students, making the signals for a game created to teach students about tree types and preferred habitat, as a precursor activity in Lesson II: 'The Tree Knows Best!'. Left is one student posing as a Douglas Fir, and the student on the right is a Ponderosa Pine.

Future Work

Going into future research with this age group, there are ways researchers could add these lessons, and try and achieve greater engagement and feedback.

- One possible addition is to have all the students use Legos, that way they can follow along with the instructor, and engage more fully. Researchers would need to make sure there are enough Legos for everyone.

- Continue to develop ways to incorporate **different learning styles** into the lesson plans, whether that means more visual, tactile, or audio aids for students.

Conclusion

The biggest **challenge** of starting young students on the path to be energy literate is being able to break down some of the bigger concepts such as energy conservation, and on a broader scale, the concept of energy itself. Not only do these activities have capture their attention, they must accurately teach them the building blocks of energy literacy, outlined by the USDOE Energy Literacy Principles.

Acknowledgements This work was supported by the National Institute of Food and Agriculture (NIFA), USDA Award Number: 2017-67032-26005, NARA SURE Program, and Adventure Day Camp located at the MOSS campus.