

Exploring Informal Learning Practices: Engaging K-5 Students In Learning About Woody Biomass As An Energy Source

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INTRODUCTION

This project is a contribution to NARA's (Northwestern Advanced Renewables Alliance) research on collecting discarded woody biomass (slash piles) and converting it into jet fuel. It is particularly focused on the energy literacy branch of the research which helps the effort in many ways including increasing citizen support for the production of biofuels. My research task was to develop curriculum to teach children about energy and NARA's research. Up to this point, the work on energy literacy has been primarily focused on middle and high schoolers. There is little to no information on elementary aged students, which is the targeted age group for this project. The content for the curriculum was inspired by the Energy Literacy Principles which outline the concepts an energy literate citizen should understand. Given the age group, the curriculum is not meant to teach in-depth information about energy but to provide a basis for better understanding when they get older.

Setting:

Over the summer I worked at MOSS (McCall Outdoor Science School) Adventure Day Camp once a week as an instructor for 6 to 11 year-olds. I was responsible for facilitating camp-like activities such as hiking, swimming, and crafts as well as teaching about various science topics such as space, pollinators, and rocks. In addition to this, the lesson plan I developed for energy literacy was made for and tested with the students I worked with in the camp.

METHODS

First, I decided which concepts I wanted to teach the students. I settled on what energy is, where it comes from, how we use it in our daily lives, and the difference between renewable and nonrenewable energy resources. Then, through four phases I developed a lesson plan.

Phase 1: Interviewing and observing day campers

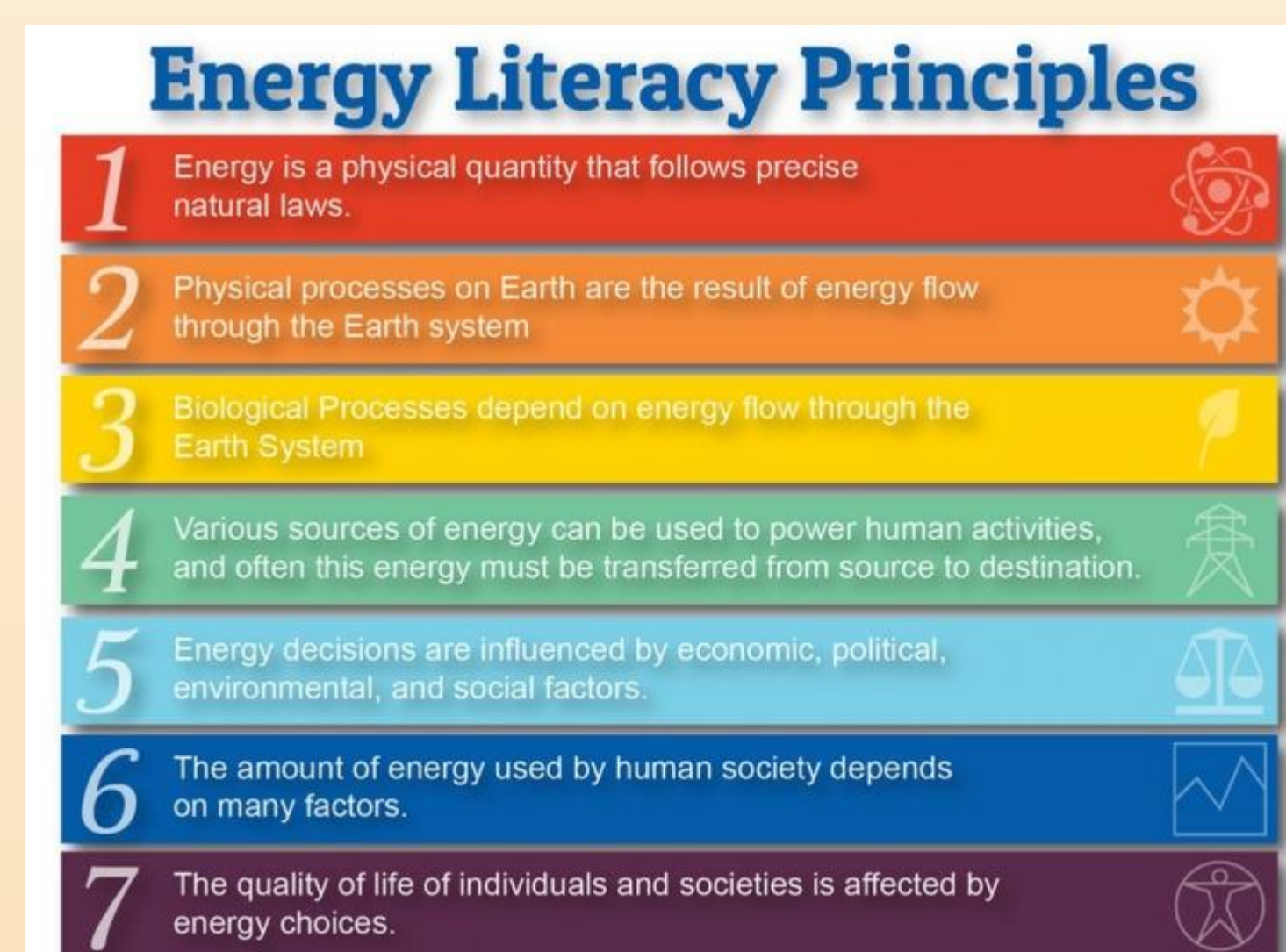
- I asked students questions to see how much they knew about energy and how they might enjoy learning.
 - Questions: What is energy? Where does energy come from? How do we use energy? What was one of your favorite activities you have done in school?
- Observation: I taught the kids for a couple weeks before I started practicing my lesson with them. Although each week I had a different set of kids of different ages, I was able to get a feel for the setting and the overall level of engagement

Phase 2: Initial lesson plan development

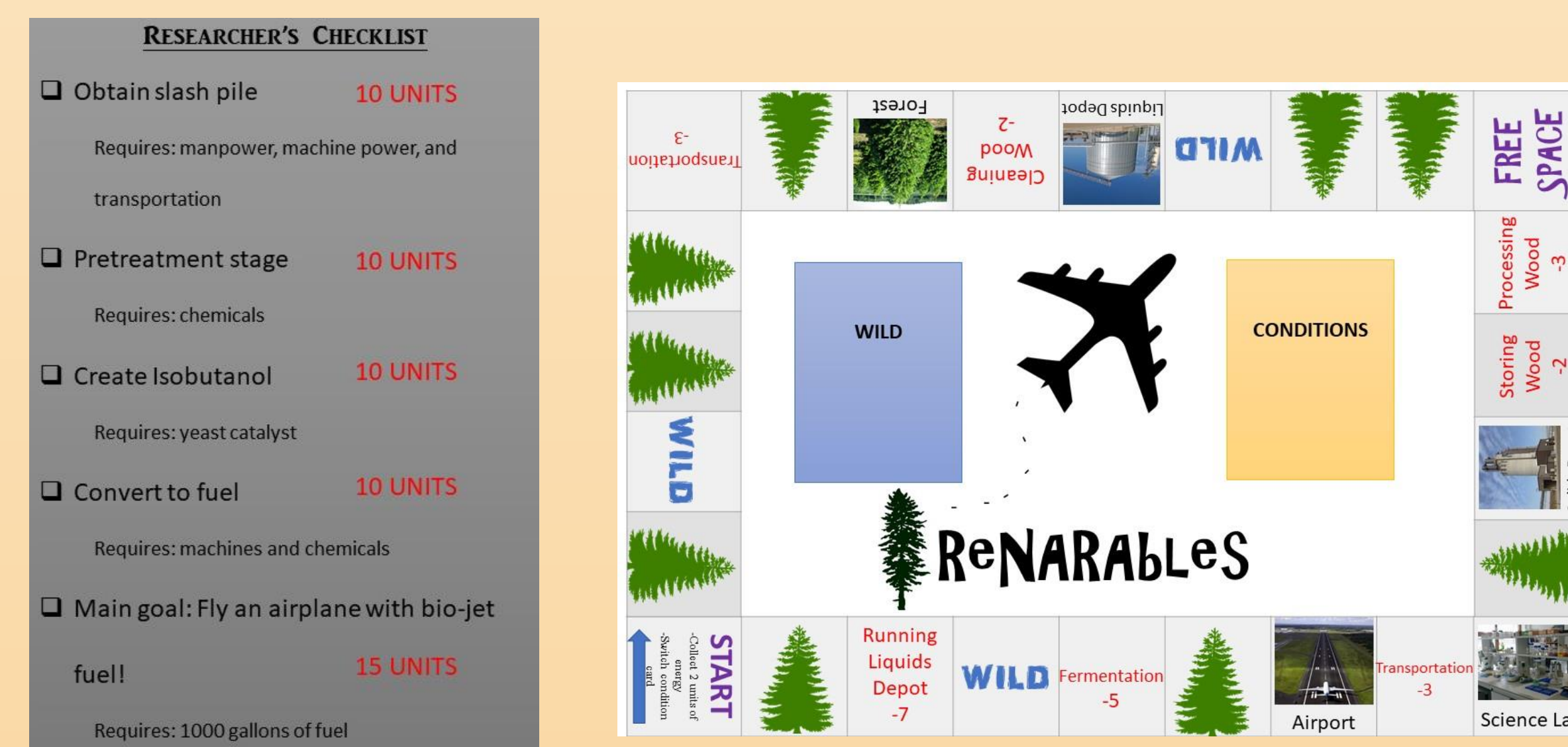
- I designed a board game thinking about a game that would represent the NARA process and also teach about the exchange of energy, what energy is, and about how renewable energy sources are better for the environment than nonrenewable sources.
 - The game is designed loosely based off of Monopoly where players go around a board to rack up units of energy and can lose energy by landing on certain spaces and there are wild cards which are like Monopoly Chance cards. The object of the game is to get enough energy to get through the various steps of the NARA process
 - I added an Introduction and Debrief to the game instructions to solidify the learning experience and plainly discuss what energy is, the NARA process, and renewable and nonrenewable resources.
 - I practiced the game with another adult to make sure it works and changed some of the values and wording as needed.

Phase 3: Pilot testing board game and Reflection

Phase 4: Revision and Retesting board game and Final Reflection



ReNARAbles



CONCLUSION/FUTURE WORK

Although it can still be improved to become more engaging and understandable for elementary-aged students, the board game I created is a useful tool for teaching students in 2nd grade and up about energy and NARA's research on producing jet fuel from slash piles. In a more formal learning setting, this game would be more successful as a teaching tool because the students have the expectation of learning and would be more engaged. In a more informal setting like the one I worked in, perhaps a more active, life-sized version of the board game would be more engaging and the students would get more out of it. Another way the game could be made more engaging is to turn it into a craft in addition to the game where the students have to make their own game pieces to play with. Another future development is to make the board game into a mobile app that can be used on phones or tablets.

ACKNOWLEDGEMENTS

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RESULTS/DISCUSSION

- Trial 1: I facilitated the game for four students aged 6-9. Half of the students were engaged and half were not. The half that were engaged did seem to understand the game and its learning objective and all of the players were able to catch on to how to play the game. Most of the students said they really liked the game.
- Trial 2: The students that participated in this trial were slightly older (8-10). There were 7 students so they all played in teams. 2 players had played before. They all seemed very engaged in the game and seemed to like it. One of the players that played again remembered what was taught the last time he played.
 - The way I conducted the first trial was no different from how I conducted the second. I think the difference in results was due to the attitude of the groups. The first group was focused on wanting to do their own crafts and wanting to go swimming while the second group had been primed by their teacher about the game and were anticipating playing.
 - I brainstormed how I could make the game more engaging, or at least the intro and debrief so that the students can take part of the lesson on what energy is, how it is used and renewable vs nonrenewable energy resources.
 - Instead of reading the Introduction part I could show a video or do a hands-on activity that presents the same information in a more engaging way.
 - In the Debrief, I decided I could add a section where I congratulate them on finishing the game and list off how they helped the environment by using bio jet fuel instead of petroleum based fuel.
 - I was thinking to make the game more challenging and interesting I could have the players answer a question in order to achieve the mini-goals. For example: What is an example of an energy source? This implants more learning about energy into the game since most of it was in the Introduction and Debrief. Having them answer the questions themselves will also help them retain the information better.
- Trial 3: This group consisted of eight 6-9 year-olds with most of them on the younger end of the spectrum. One player was 4 years old. They played in teams of 2 again. None of them were interested in learning or playing the game from the beginning and it went very slowly and they were all very uninterested and distracted. They did not finish game but I was able to get through the Debrief. I implemented the change in the Debrief and used a fellow intern's video on energy in place of the Introduction.
 - In this trial, these changes did not seem to impact the quality of the learning experience in a negative or positive way. However, the conditions of the trial (the kids being so young and distracted from the beginning) makes it difficult to gauge the efficacy of these changes.
- Trial 4: In this game, six 6-10 year-olds played; three of whom had played before. I implemented a matching activity in place of the Introduction, the new change to the Debrief, and had players answer a question about energy to attain the mini-goals. These students were also disinterested from start because they wanted to go swimming. Despite this, the changes I implemented for this final trial did add a higher level of engagement and learning.
 - There is room for improvement for the questions because the students seemed confused about the questions and needed clarifications. It might also help to increase clarity in the Introduction so they can have a better understanding of the terms used in the questions.

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