Model Eliciting Activities With K-12: Adventures With the SustainabilitySuperheroes.org

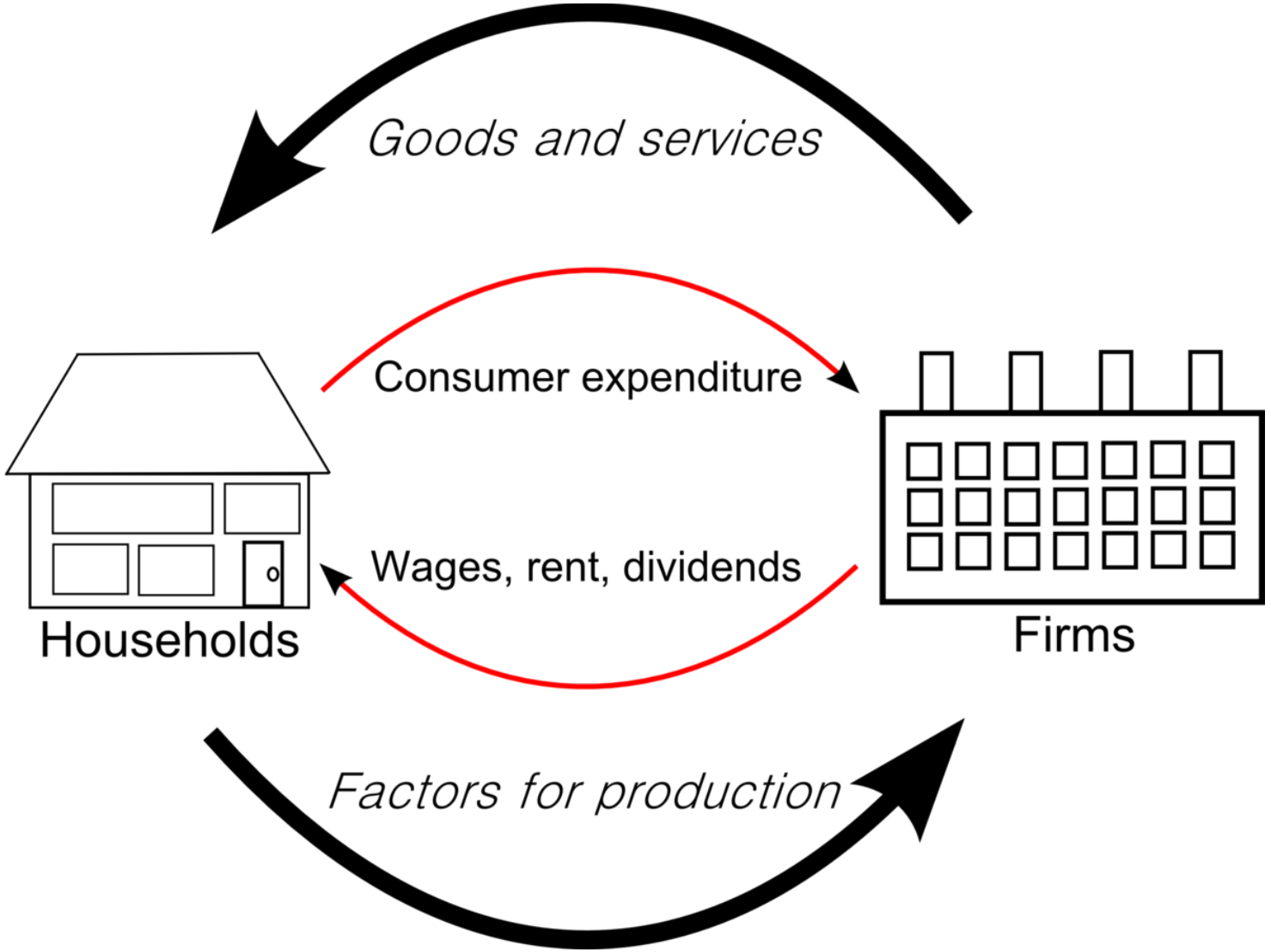
Deborah Kozdras dkozdras@usf.edu

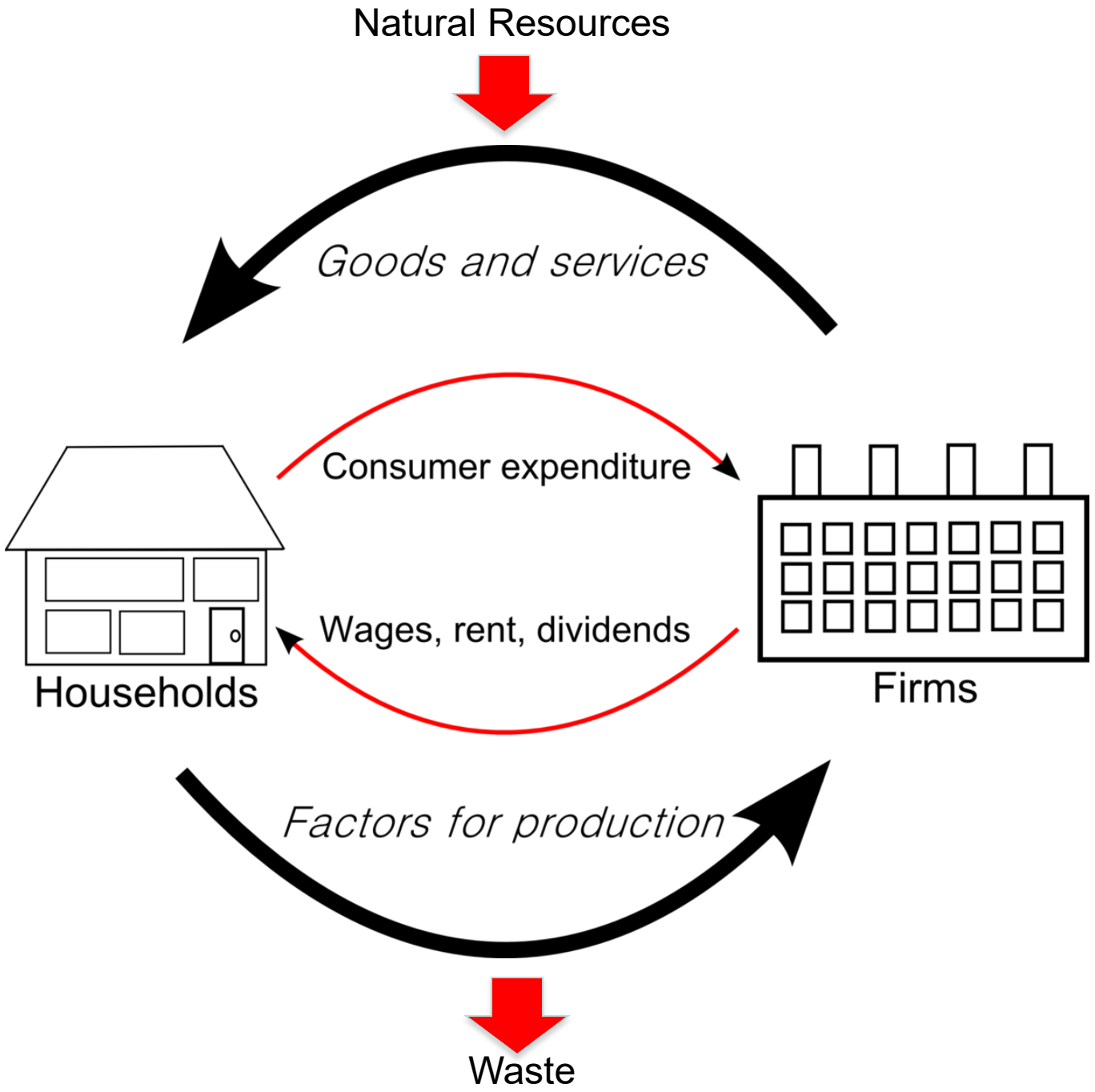
USF / COLLEGE OF EDUCATION
GUS A. STAVROS CENTER FOR FREE ENTERPRISE AND ECONOMIC EDUCATION

U.N. Definition of Sustainable Development

In 1987, the **UN** Brundtland Commission defined **sustainable development** as: "*meeting the needs of the present without compromising the ability of future generations to meet their own needs."*

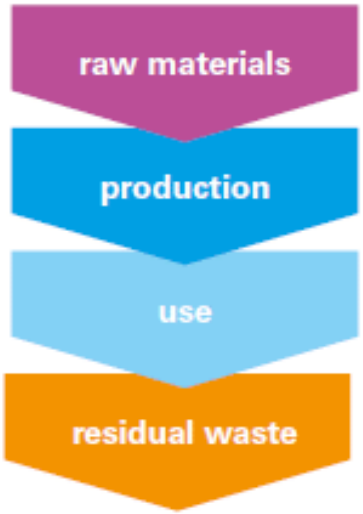
(Report of the World Commission on Environment and Development.)


Goods and services
Consumer expenditure
Wages, rent, dividends
Households
Firms
Factors for production

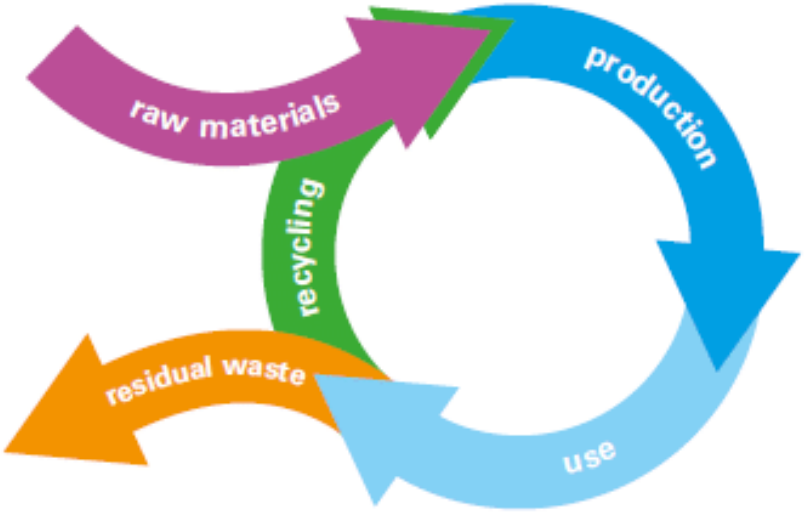

Natural Resources
Goods and services
Consumer expenditure
Households
Wages, rent, dividends
Firms
Factors for production
Waste

Sustainability: Triple Bottom Line

LINEAR ECONOMY



ECONOMY WITH FEEDBACK LOOPS



CIRCULAR ECONOMY

“The problems that we face in our ever-changing increasingly global society are multidisciplinary, and many require the integration of multiple STEM concepts to solve them.” (Roehrig, Moore, Wang, & Park, 2012)

Model-Eliciting Activities

Open-ended

Problem-based

Interdisciplinary

Designed as “thought-revealing activities” for students (Lesh, et al, 2000)

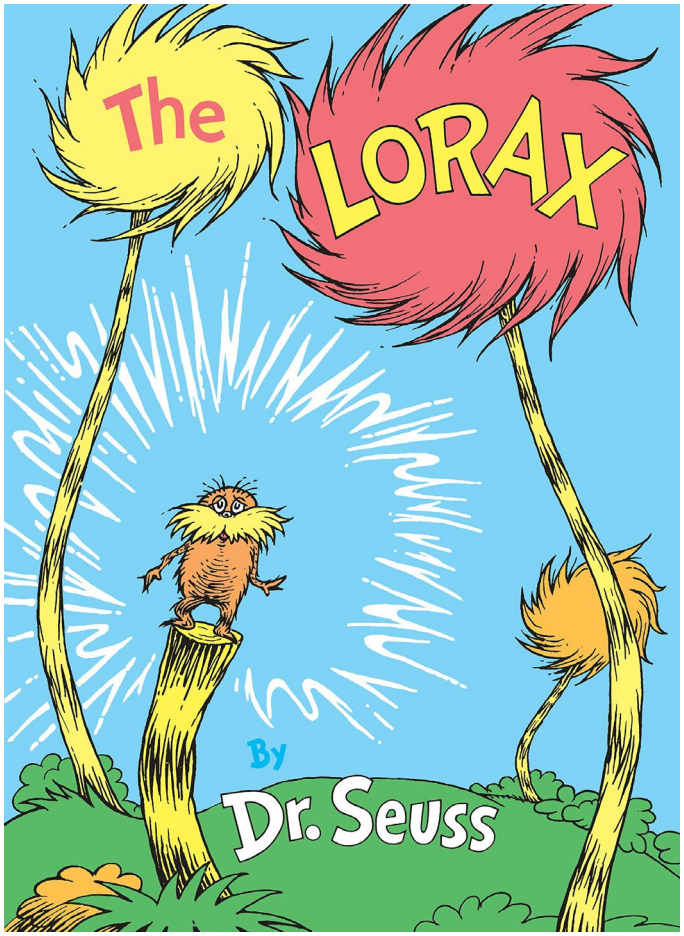
About MEAs

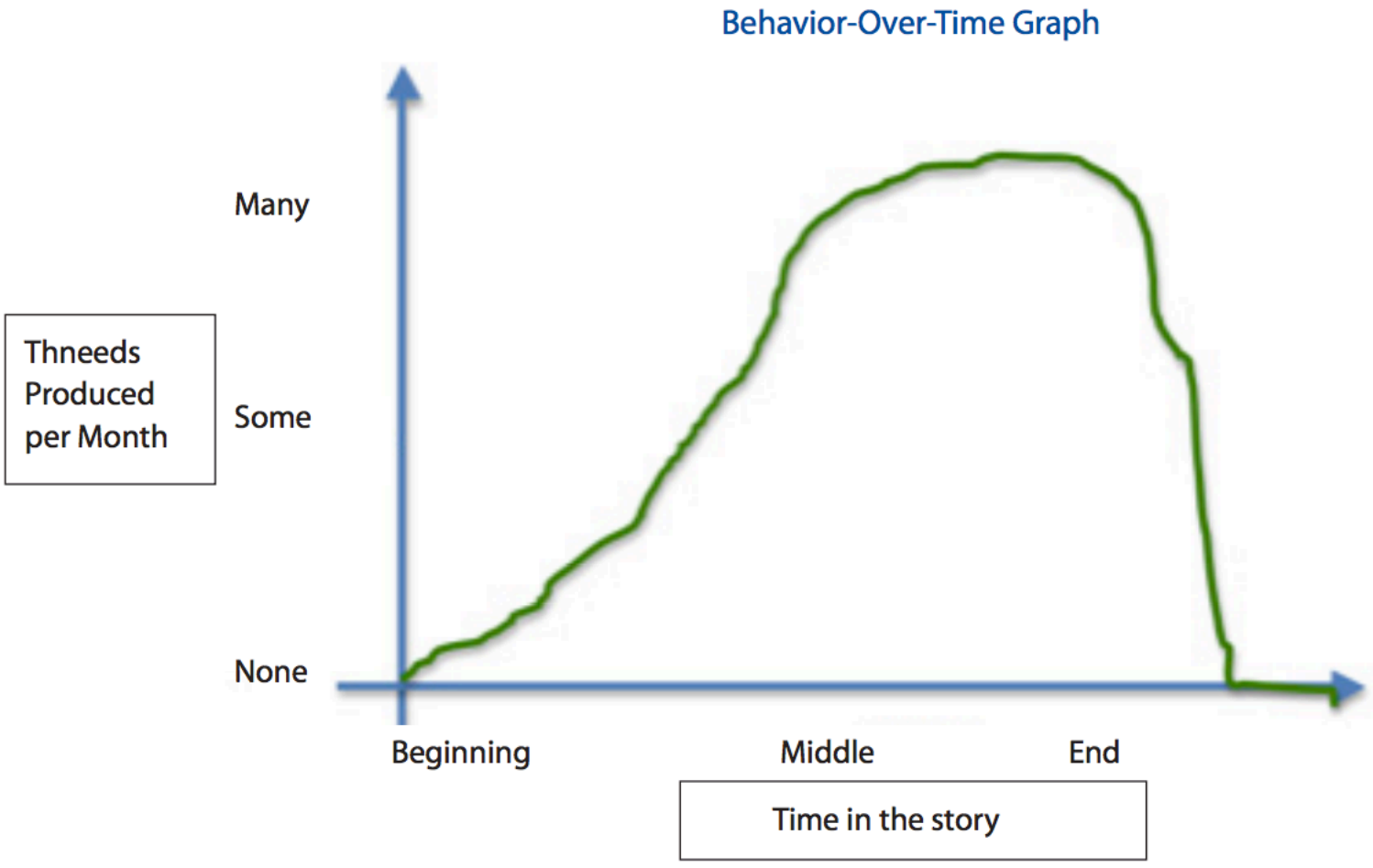
Students will engage in:

- Critically reading texts
- Applying problem-solving strategies
- Working mathematically
- Communicating effectively

"The resultant student products reveal students' thinking and provide both teachers and researchers with a powerful lens for viewing students' reasoning and concept development (Carlson, Larson, & Lesh,2003)

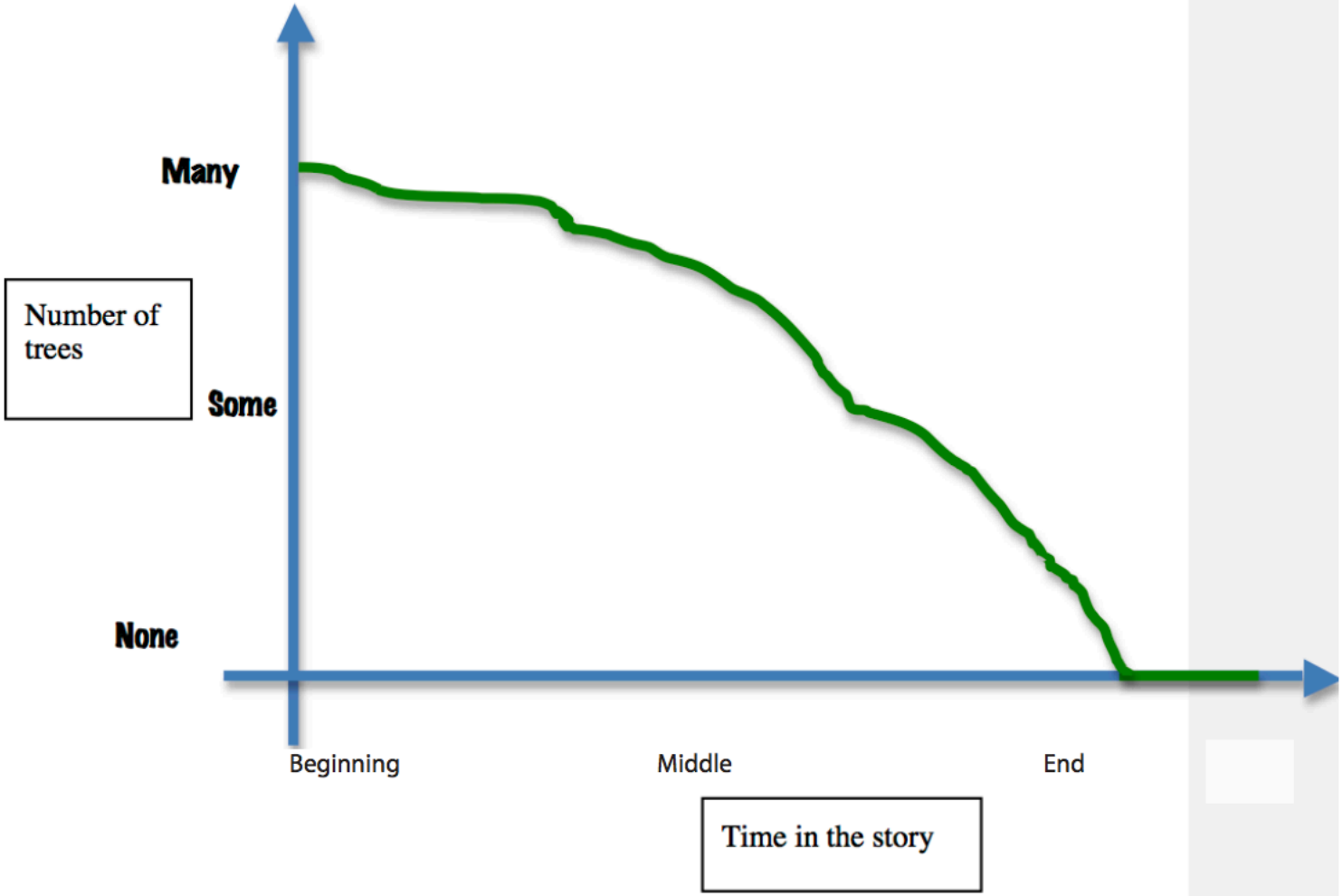
Model Eliciting . . .





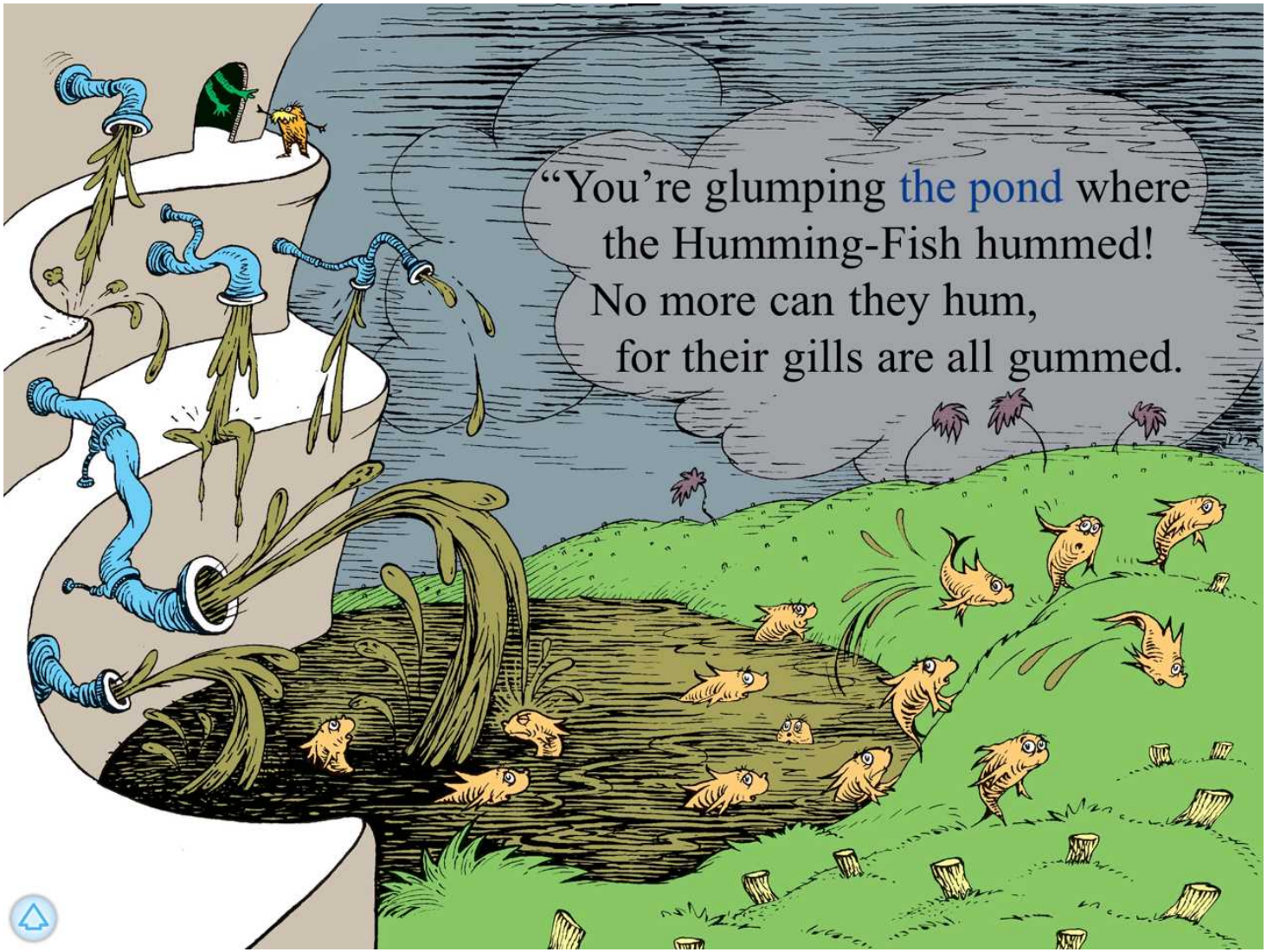
"Thneeds Produced per Month" starts as a low, flat line that grows quickly to a high level and eventually crashes down to zero.

http://static.clexchange.org/ftp/documents/x-curricular/CC2012_TheLoraxGraphsLesson.pdf



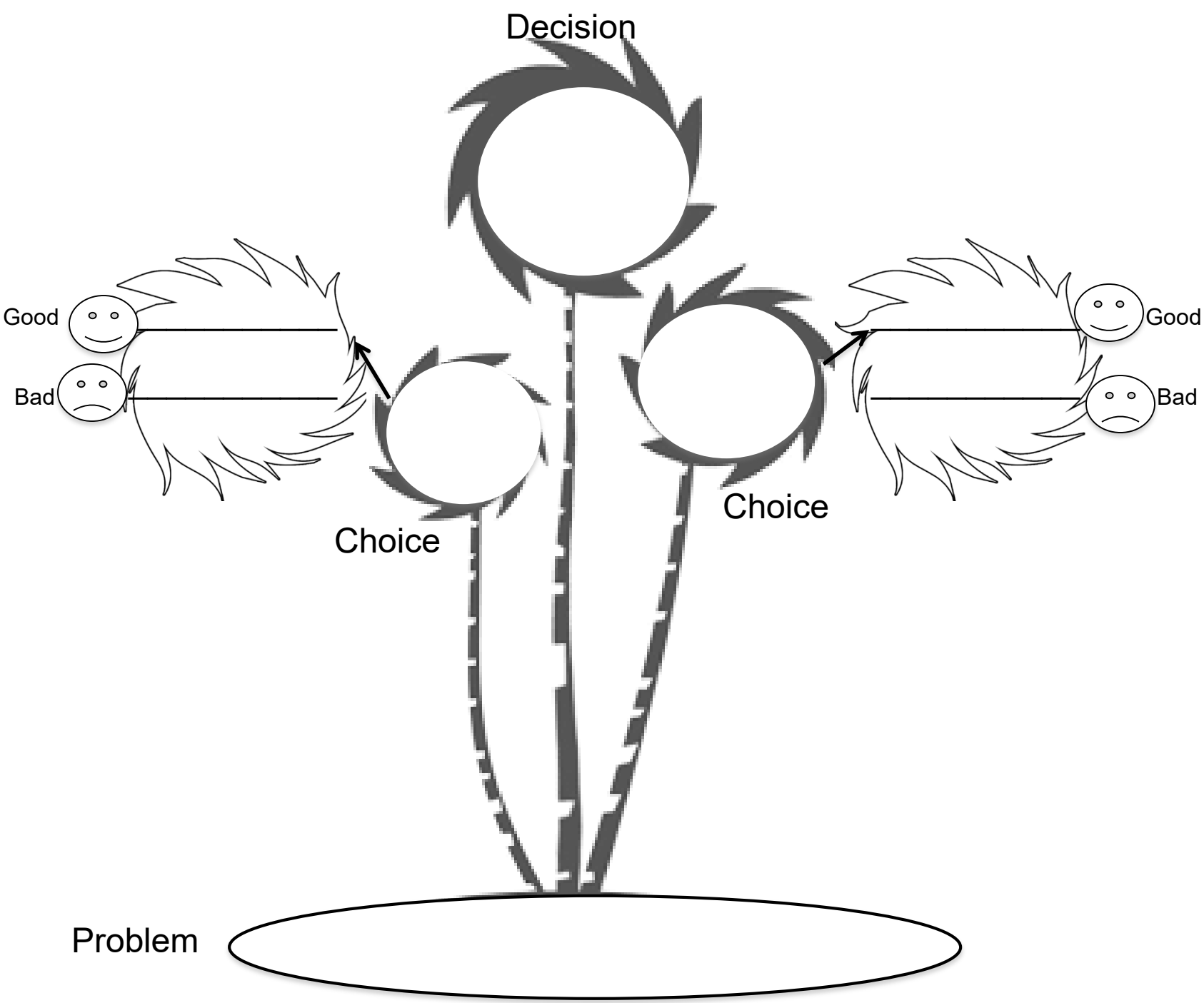
Explanation of graph:

When the Once-ler first arrived, there were lots of trees. First he cut one down, then he called his relatives to work with him. He invented the Super-Axe-Hacker and could cut down lots of trees at once. His business grew and grew until all the trees were cut down.



And the Humming Fish which cannot live in "gluppity glop" and "schloppity schlop" go in search of clean water. (Water pollution)

The Swomee Swans, with “smogulous smog” in their lungs, also fly for clearer skies. (Air pollution)


Decision
Good
Bad
Choice
Choice
Good
Bad
Problem

First Grade – Recycling

Problem

- Where should the new recycling bin be placed?

Alternatives

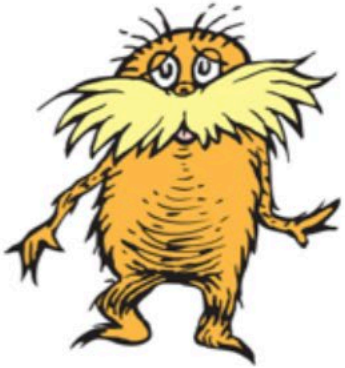
- Near vending machines, in the employee parking lot, at the outdoor break area, outside the back door, by the street entrance.

Criteria

- Easy to get to, near where employees might have food or drinks, opportunity for other community members to use the bin, many people pass by it.

Decision

- Should the new recycling bin go by vending machines, the employee parking lot, the outdoor break area, outside the back door, or near the street entrance?



Sustainable Thneeds Inc.
2015 Solution Way
Cleanville, FL 36498

Dear Students,

My name is The More Than Once-ler and I am the new Sustainability Manager of Sustainable Thneeds Inc., a manufacturing company in Florida. We are building a new factory in Florida and need to decide which type of energy to use to power it. The kids in the local community want us to use a form of energy that will protect Florida's environment so that they will have a clean and safe place to live. We have given you an energy chart to help you make your decision.

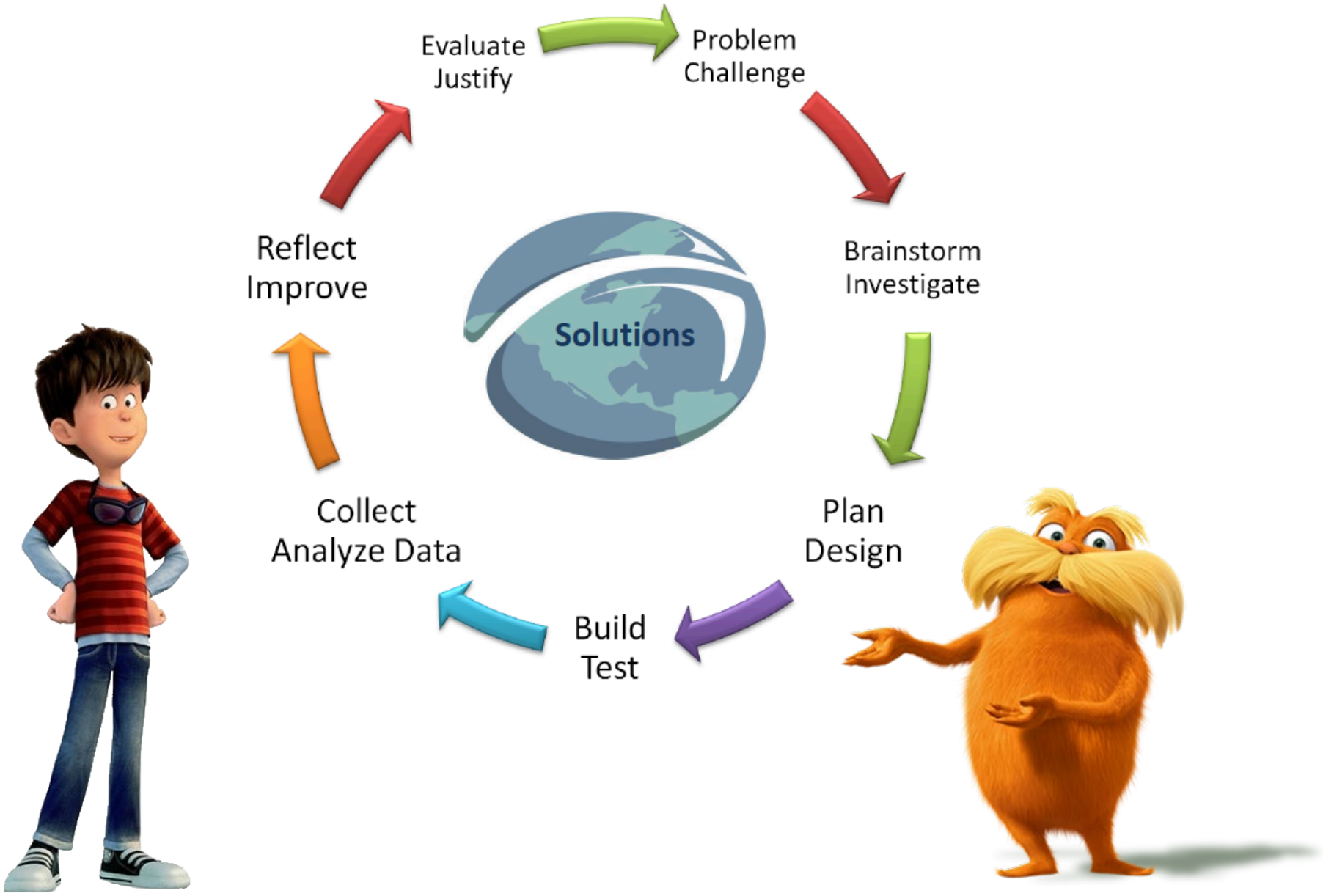
Please write us back on the attached template, including how you arrived at your decision. Thank you for your assistance with this project!

Regards,
The More Than Once-ler
Sustainable Thneeds Inc.

Energy Source	What is it?	Renewable or nonrenewable?	What problems does it cause?
Biomass	Biomass is anything that is alive. It is also anything that was alive a short time ago. Trees, crops, garbage, and animal waste are all biomass. Most of the biomass we use for energy today is wood. We burn wood to make heat.	Biomass energy is renewable, which means more biomass can be made in a short time. We can always grow more plants.	Burning biomass doesn't cause as much pollution as burning coal. But many people don't like to burn waste near their towns. Sometimes it smells bad. Waste-to-energy plants work to scrub the air from the burning waste to reduce pollution and smells.
Coal	Coal looks like shiny, black rock. Coal has lots of energy in it. When it is burned, it makes heat and light energy.	The coal we use today took millions of years to form. We can't make more in a short time. That is why it is called nonrenewable.	Most coal is buried under the ground. We must dig it out—mine it. Mining can damage land because often all of the trees are cut down and the ground is dug up. When coal is burned, it can pollute the air.
Petroleum	Petroleum is a liquid that is found underground. Sometimes we call it oil. Oil can be as thick and black as tar or as thin as water. Petroleum has a lot of energy. We can turn it into different fuels—like gasoline, kerosene, and heating oil. Most plastics and inks are made from petroleum, too.	The petroleum we use today was made hundreds of millions of years ago. We can't make more in a short time. That's why we call petroleum nonrenewable.	Petroleum can damage our environment. Burning fuels made from oil can pollute the air. Pollution from cars is a big problem in many parts of the country. Oil can pollute soil and water, harming the animals that live in the area.
Natural gas	Natural gas is similar to air—it is a mixture of gases you can't see, smell, or taste. But it is different, too. It has a lot of energy in it. You can burn it to make heat. Natural gas is found underground in pockets of rock. We drill wells into the ground to reach the gas so that it can flow to the surface.	The natural gas we use today took hundreds of millions of years to form. That's why we call it a nonrenewable energy source. We can't make more in a short time.	Natural gas is the cleanest burning fossil fuel. It doesn't pollute the air as much as coal or oil.

solar	Energy we get from the sun is called solar energy. It travels from the sun to the Earth in rays. Some are light rays that we can see. The sun is a star. It is a giant ball of gas. It sends out huge amounts of energy in the form of light and heat every day.	Solar energy is free and clean. There is enough for everyone, and we will never run out of it. Solar energy is renewable. The sun will keep making energy for a very long time.	The hard part is capturing the sunlight. It shines all over the Earth and only a little bit reaches any one place. On a cloudy day, most of the light never reaches the ground at all.
wind	Wind is moving air.	As long as the sun shines, there will be winds on the Earth. We will never run out of wind energy. It is a renewable energy source.	Some people don't like the way wind turbines look. Sometimes birds crash into them and become injured.
Hydropower	Hydro comes from the Greek word meaning water. Hydropower is the energy we make with moving water. Moving water has a lot of energy. We use that energy to make electricity.	Hydropower a renewable energy source. It does not create pollution and is cheap.	When dams are built to make hydropower, the reservoirs flood a lot of land. They change the flow of the rivers. Sometimes, fish can't swim up the rivers and lay their eggs like they could before.

Design a Solution



SustainabilitySuperheroes.org

In the end, we will conserve only what we love. We only love what we understand. We only understand what we are taught . . .
Babia Dioum, *Senegalese ecologist*

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