SECRET LIFE OF STUFF

People and the Planet
Lessons for a Sustainable Future

INTRODUCTION

Our "stuff" has a secret life – a life that exists long before it reaches your hand as a consumer and extends long after. For instance, consider the shirt you are wearing. Your shirt may have begun its life in a field of cotton requiring water and, most likely, fertilizers. The cotton was then processed and manufactured, using a lot of energy and chemicals and perhaps traveling quite a distance along the way. Next, the shirt was packaged with a variety of materials, each of which has its own life, and then lastly, it was transported to the store. Once at home, it gets washed and dried regularly, which uses a lot of water and electricity. When it finally wears out (or you become sick of it) it will end up in the landfill, where it lives out the rest of its days.

Most people aren't aware of the stages our stuff goes through, not to mention how those stages impact the planet. A **life cycle analysis, or LCA**, is a technique that assesses the environmental impact of a product and can help identify changes that will decrease a product's eco-impact over the course of its life. With population growing and more goods being consumed, it's important that we consider the impact of not only ourselves, but also our stuff.

MATERIALS

- Student Worksheet
- Several of each "analysis item"
- Life Cycle Analysis Chart (provided)

PROCEDURE

1. Before class, set up four Analysis Stations each with several of the "analysis items." Make substitutions as necessary. (One station will have several pairs of jeans, the next will have several pairs of sneakers, etc.)

   Analysis Items

Jeans	Ear buds
Sneakers	Small lamp (without lightbulb)

CONCEPT

There are five basic stages in a product's life cycle and each stage contributes to the product's overall impact on the planet.

OBJECTIVES

Students will be able to:

- Name and sequence the five stages of a product's life cycle.
- Explain what factors influence the environmental impact of each life cycle stage.
- Conduct a basic life cycle analysis of a consumer product.
- Compare the five life cycle stages of four different products and use reasoning to determine which product has the lowest overall eco-impact.
- Formulate a plan for decreasing the impact of a product by altering one stage of its life cycle.

SUBJECTS

Science (Earth and environmental), social studies (economics), family and consumer sciences

SKILLS

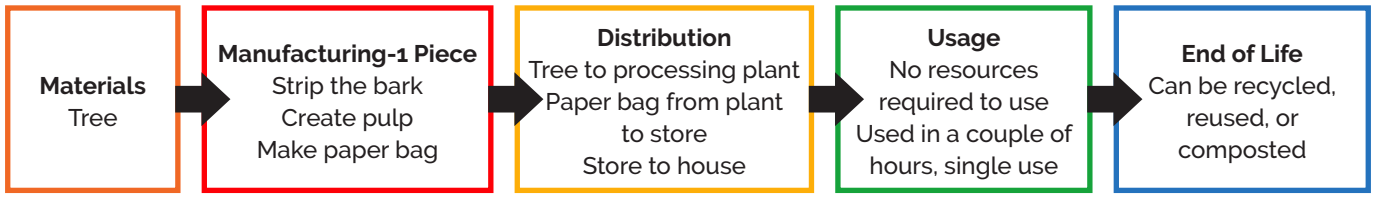
Critical thinking, comparing and evaluating, collecting and analyzing data

METHOD

Students compare the life cycle stages of four everyday products in order to hypothesize which item has the lowest environmental footprint. Students then pick one product and brainstorm improvements that could be made along the product's life to minimize its eco-impact.

2. Hold up a paper grocery bag in front of the class and explain that the bag, an everyday product, has a secret life – a life cycle just like living things.

3. Ask students to hypothesize what they think it means to conduct a life cycle analysis (LCA) of a product and then brainstorm the paper bag's life cycle as a class. You can show students the circle image on the front page if they have trouble determining the five stages. As you go through each stage as a class, ask students to think about what factors influence the environmental impact of that stage.



4. Here's an overview of potential impacts during each stage:

   Materials *– The materials used to create a product must come from somewhere. Some are extracted from mines, others are grown specifically to be used by humans, while others might be taken from the ocean or a forest. Removing these materials impacts the Earth's natural resource base and gathering them requires energy. If the materials are recycled or sustainably managed, their footprint is decreased.*

   Manufacturing *– Each piece of a product has to be created separately before being combined with the other parts. The manufacturing of each piece requires energy and can produce toxic waste. The processing of metals and plastics is especially resource intensive, because they must be melted and refined before use.*

   Distribution *– Many things have to be transported for a product to exist – the raw materials to the production factory, the product to stores, and finally, the product to consumer homes. All of this transportation emits greenhouse gases and contributes to the eco-impact of the product.*

   Usage *– Some things require energy in order to be used (appliances, electronics, cars, etc.), and this gets factored into their life cycle analysis. Length of use also plays a role – items that can be used longer have less of a footprint, since they don't need to be replaced by new versions as often.*

   Disposal *– Both the product itself and its packaging must be eliminated. Materials that can be recycled or composted, like cardboard, have less of an impact than those that can't, like Styrofoam. Some items are also easier to reuse or donate than others.*

5. Distribute the Student Worksheet and explain that in small groups, they will be conducting a life cycle analysis for four different products – a pair of jeans, a pair of sneakers, a set of earbuds, and a lamp. Point out the four analysis stations set up around the room.

   Note: The following list provides more information on common materials used in everyday products. You can chose to share this information with students before, during or after the station analysis, or not at all.

- silver, copper, aluminum, tin, iron, silver, nickel, clay – mined from the ground
- plastic/nylon – made from coal, natural gas, and crude oil that is mined from the ground
- silicon – made from silica, which is mined from sand or rock
- rubber – made from latex which is extracted from rubber trees

6. Before beginning, ask each student to turn to a partner and discuss which of the four products they think has the smallest eco-impact and why. They should record this hypothesis at the top of their Student Worksheet.

7. Divide students into groups of 3-4 and direct each group to one of the four analysis stations – it's okay to have more than one group at a station.

8. Groups should spend 15 minutes at each station working through the phases of the product's life cycle. To record their thinking, each student should fill in their Life Cycle Analysis chart. Students do not need to know the exact information for each product/stage. The goal is to have them think through the stages and make reasonable conclusions. Alternatively, or to save time, small groups could each analyze one product, and then the class could come together to discuss each product and determine rankings in each category.

   Notes:
   - It will work best if students write the rankings in pencil, as they will likely change as the lesson progresses.
   - You may need to clarify that the rank identifies how they think that product compares to the other three products on that particular stage of the LCA.
   - You may want to structure the 15 minutes so that students spend the first three minutes observing and the next 12 minutes discussing with peers and recording notes.

9. After all groups have moved through all of the analysis stations, give them time to answer the three questions on the Student Worksheet.

10. Go through the Discussion Questions as a class.

Answers to Student Worksheet

Materials used - You can share this information after the analysis stations (during discussion), can provide a "word bank" of these materials for students to choose from during the analysis, or not share them at all.

Jeans: *cotton; indigo dye; copper (rivets); steel (buttons, zipper)*

Sneakers: *rubber (sole); foam, polyurethane, silicone (middle sole); canvas, leather, nylon (body); plastic (eyelets for laces)*

Earbuds: *plastic (outer covering); copper (wire), nickel or copper (plug), plastic or foam (earbud covering)*

Lamp: *ceramic, metal, glass, or plastic (base); ceramic, plastic, aluminum, or brass (socket); brass or silver (plug); copper (wire); plastic (wire covering, switch)*

Answers to other categories and rankings will vary.

DISCUSSION QUESTIONS

1. How accurate do you think your rankings were? Why?

   Answers will vary. You may need to explain to students that there is not one right answer to which product has the smallest impact. Rankings may differ depending on which criteria individual students focused on (energy use, materials, packaging, etc.)

2. What did you find difficult about conducting a life cycle analysis?

3. Are there aspects of any of the product life cycles that weren't included in this analysis but would impact their eco-impact?

   Production of the packaging materials (in addition to their disposal), how energy intensive it is to extract different types of materials, what type of energy is being used during the manufacturing stage (coal vs. natural gas vs. renewables), the impacts of maintaining the materials' source (fertilizers, habitat destruction, etc.).

4. Our human population is rapidly growing. How will this impact the story of our global family's "stuff?"

   With more people on the planet, there is demand for more products. It is important that we consider ways to reduce the eco-impact of material goods as our population continues to grow.

5. As a consumer, how could you use your knowledge of LCA to decrease your own personal footprint?

   Reduce your consumption of "stuff" – if you don't buy it in the first place, there is less demand for products to be made. When you do purchase "stuff," buy products that are locally made and with locally sourced materials whenever possible; buy from second hand stores; don't buy more than you need and don't buy a replacement until it's absolutely necessary; support brands that use sustainably managed materials; buy from companies that are making an effort to decrease the eco-impact of their products; buy products with less packaging. Once you've purchased an item, unplug it between uses, line dry clothes and cut-down on washing, reuse it or donate it instead of throwing it away after use.

6. Do you think companies should be required to perform LCA's on their products and to make the results public for consumers? Why or why not?

7. In addition to its eco-impact, what other aspects of a product could a consumer consider before buying it?

   Answers may include: the work environment and wages for the workers who create the product, manufacturing in the U.S. versus abroad, or if a product is fair trade (producers from developing countries receiving a fair price for their product).

ASSESSMENT

Students pick one item that they are wearing and create a basic flow chart that illustrates that item's life cycle.

FOLLOW-UP ACTIVITIES

1. Ask students to compare and contrast the life cycle of a man-man product with that of a familiar plant or animal.

2. Have students research one of the "analysis" items to see if anything is being done to lower its environmental impact. For example, Nike uses a program called Nike Grind to create sports fields out of pieces of old shoes that were otherwise bound for the landfill.

3. Watch the following videos as a class to give students a real glimpse of what's inside a pair of LED sneakers and a MacBook pro.

    - What's Inside: LED Sneakers
    - What's Inside: Rose Gold MacBook

Sources: United States Environmental Protection Agency, "Climate Change and Waste."

SECRET LIFE OF STUFF

STUDENT WORKSHEET

Name: _____ Date: _____

Spend 15 minutes at each station conducing a life cycle analysis of that station's product. As you move through each stage of a product's life, rank how you think the product compares to the other three products in regard to that life cycle stage. (Rank of 1 = most eco-friendly within that stage; Rank of 4 = least eco-friendly within that stage) For example, the item that requires the least miles in distribution would rank 1 for the distribution stage.

1. Hypothesis: Which of the four products do you hypothesize will have the smallest eco-impact? Why?

_____

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2. Fill out the Life Cycle Analysis chart on the next page. Then answer questions 3-5.

3. Consider your rank of each product along each phase of its life cycle. Do you agree with your hypothesis? Why? If not, which product do you now think has the lowest eco-impact?

_____

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4. Choose one product and determine which stage of that product's life has the biggest environmental impact. What could be done differently during that stage to reduce the product's overall eco-impact?

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5. What might be the challenges of enacting this change? Would any aspect of the product suffer?

_____

_____

_____

LIFE CYCLE ANALYSIS CHART

	Materials Remember that each material has to be extracted from the Earth and has its own life cycle.	**Manufacturing** Remember that each piece has to be produced separately, and plastics and metals need to be processed.	**Distribution** Remember to consider where the materials come from and where the product is produced.	**Usage** Some products require resources during use. Some can be used longer while others have to be replaced quickly.	**End of Life** Remember to consider the end of life for the packaging too. Some materials are easier to recycle, compost, or reuse.
Blue Jeans	Materials list: Rank _____ of 4	Number of Pieces: Rank _____ of 4	Transportation: Rank _____ of 4	Resources required in use: Average length of use: Rank _____ of 4	Packaging: Rank _____ of 4
Pair of Sneakers	Materials list: Rank _____ of 4	Number of Pieces: Rank _____ of 4	Transportation: Rank _____ of 4	Resources required in use: Average length of use: Rank _____ of 4	Packaging: Rank _____ of 4
Earbuds	Materials list: Rank _____ of 4	Number of Pieces: Rank _____ of 4	Transportation: Rank _____ of 4	Resources required in use: Average length of use: Rank _____ of 4	Packaging: Rank _____ of 4
Lamp	Materials list: Rank _____ of 4	Number of Pieces: Rank _____ of 4	Transportation: Rank _____ of 4	Resources required in use: Average length of use: Rank _____ of 4	Packaging: Rank _____ of 4