WHAT CAN WE DO WITH ALL THIS STUFF?

Teacher's Guide

Grade: 3-5

Lesson: What can we do with all this stuff?

Number of Class Periods:
4-5 45-minute periods

TERRACYCLE

The Cloud Institute for Sustainability Education

WHAT CAN WE DO WITH ALL THIS STUFF?

Standards

Common Core State Standards

www.corestandards.org/the-standards/english-language-arts-standards

ELA

Grade 3
Writing 2 a-d, 7, 8
Speaking and Listening 1 a-d
Language 1, 2, 3, 6

Grade 4
Writing 2 a-e, 7, 8
Speaking and Listening 1 a-d
Language 1, 2, 3, 6

Grade 5
Writing 2 a-e, 7, 8
Speaking and Listening 1 a-d
Language 1, 2, 3, 6

MCREL Standards Level 3-5

Geography Standard 16

5. Knows the advantages and disadvantages of recycling and reusing different types of materials.

EfS Standards

Dynamics of Systems and Change

C. 5 Be able to illustrate that what we see happening around us depends on where we are in the system (perspective consciousness).

C. 17 Make choices and decisions and takes action(s) that maximize the health of the whole system upon which the specific part(s) depend(s).

C. 30 Demonstrate that cause and effects are not closely related in time and space in a system (there are delays in systems).

C. 39 Determine which leverage points have the greatest impact and which have the least so that they can identify where to intervene in the system(s) for the best possible impact on the system(s) consistent with the stated goal(s).

C. 46 Change perspective to increase their understanding of the system.

C. 47 Recognize/identify how mental models and paradigms affect current reality and create our futures.

Inventing and Affecting the Future

F. 7e Make a case for why global citizens should understand the basic natural laws and principles including: materials cycle.

Sense of Place

I. 26 Build a model of a green school as a prototype for their school.

Enduring Understandings

1. A healthy and sustainable future is possible. We can learn how to live well within the means of nature.

3. Healthy Systems have Limits. Tap the power of limits.

9. Read the feedback. We need to pay attention to the results of our behavior on the systems upon which we depend.

10. It all begins with a change in thinking. Thinking drives behavior and behavior causes results.

12. We are all responsible. Everything we do and everything we don't do makes a difference.

LESSON SUMMARY

In this lesson, students consider the idea of "zero waste" and their part in making this a reality. Using the Waste Hierarchy as a tool, they categorize and label the stuff that is discarded in school and at home. Understanding that instead of being part of the problem, we can be part of the solution to the challenge of zero waste; students explore several habits of systems thinkers, making connections to themselves and the challenge of eliminating the concept and reality of "waste" now and over time. They practice one or more of the habits as they grapple with finding a use for an item currently discarded as "waste."

OVERARCHING QUESTION

What can we do with all this "stuff"?

GUIDING QUESTIONS

- How do we define "waste?"
- What do we waste? Why?
- What is the "Waste Hierarchy"?
- What will it take to eliminate the word waste from our language?
- What can we do to help make the idea of waste "extinct"?
- What is a living system?
- What do we do with the stuff that's already in our living system?
- Why does creating a "no waste" world matter?

Resources/materials for this lesson:

- Material Cycle Hierarchy (teacher and student resource)
- Handouts: Habits of a Systems Thinker Sets (Cut out and provide one set per student)[1]
    - Considers how mental models affect current reality and the future
    - Changes perspective to increase understanding
    - Uses understanding of system structure to identify possible leverage actions
    - Recognizes the impact of time delays when exploring cause and effect relationships
- TerraCycle Designers Brainstorm Video[2]

[1]For the restricted use in the TerraCycle lesson set, Dynamics of Systems and Change written by The Cloud Institute and to be published on the TerraCycle website with requested credit given to The Waters Foundation as indicated below.

Habits of a Systems Thinker cards ©2010 Waters Foundation, Systems Thinking in Schools.
To purchase a complete set of the Habits cards go to www.watersfoundation.org/webed/main/prod-desc/product-description.html

[2]www.youtube.com/user/TerraCycleVideos?blend=8&ob=5#p/search/1/n-VtyvhKwaY

Note to teachers: This lesson can stand alone, or can be taught as the third lesson in the sequence of lessons beginning with the Natural Laws and Principles and then Healthy Commons to reinforce and extend students' prior knowledge. If students have already experienced those lessons, then direct links and references can be made to this lesson. If those lessons have not been used, it may be helpful to review them so that activities and resources can be tapped if the need or interest arises.

LEARNING OPPORTUNITIES, ACTIVITIES, AND PROCEDURES

Diagnostic:

1. Individually, have students create a semantic map or web that illustrates their understanding of the term "waste."

Note to teachers: Review responses to discover misunderstandings or anything else that might indicate the need for a conference or small group intervention. Keep the maps/webs to show changes in understanding in different colors over time as the lesson progresses.

DAY 1

HOW DO WE DEFINE WASTE?

Context setter:

1. Introduce the first Habit of a Systems Thinker that students will be focusing on:

Mental Model = The mindset we have as a result of our beliefs, experiences and learning.

2. Ask: What do you do with stuff that you're finished with or don't want anymore, like packaging, containers or food? How does what you believe about this "stuff" help you to decide what to do when you're done with it?

3. Introduce and unpack the image:
   - What could we upcycle?

4. Present students with the challenge:
   - What kind of thinking created this problem in the first place?
   - What different way of thinking will we use to create the solutions?
   - What will it take to make the word "waste" extinct?
   - What can we do to help make this happen?

Note to teachers: Remind students that there is no such place as "away", and that we need not be the only species on the planet that produces waste that contributes no value to our living systems.

5. Discuss and document key responses or insights that come from the conversation. Explain that this is their challenge – for this lesson, and beyond.

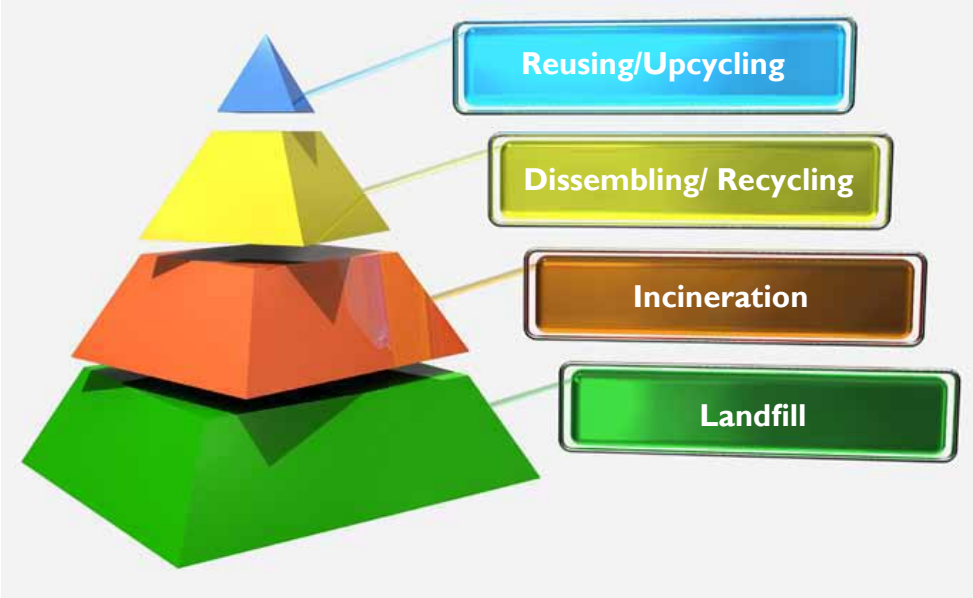
DAY 2

WHAT IS THE "WASTE HIERARCHY"?

1. In small groups of 3-5, students go on a "waste" hunt, surveying and documenting (listing, photographing, drawing, etc.) the "stuff" that is discarded in the school.
2. When groups return from their expeditions:
    a. Discuss what they discovered.
    b. Ask for ideas about the mental models that might be behind what they have noticed.
3. Introduce and discuss the Hierarchy of Waste.
4. After school, each group member also surveys and documents the waste produced in his/her own home.

TERRACYCLE'S MATERIAL CYCLE HIERARCHY

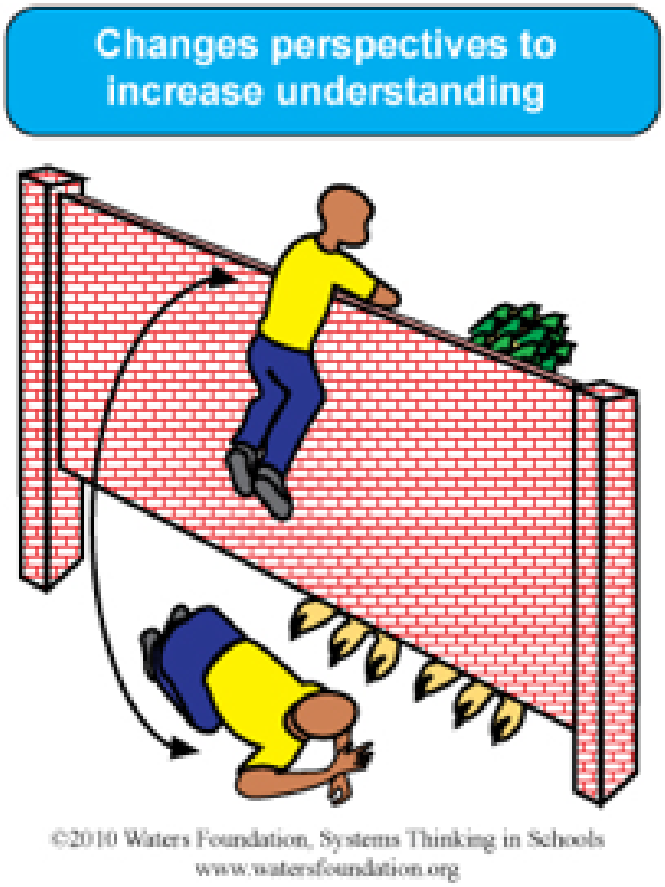
1. FLEXIBLE PACKAGING: Bags, envelopes, pouches, sachets, wraps, etc., made of easily yielding materials such as film, foil, or paper sheeting which, when filled and sealed, acquires pliable shape. These packages are typically sent to a landfill. These are options for the waste stream (1 is most desirable, 5 is least):
    1. Upcycle add value by using the material as (e.g. using candy wrappers to make a tote bag)
    2. Reuse (for instance using a yogurt cup and making into a planter)
    3. Dissemble/recycle – creating plastic pellets –to use as plastics
    4. Incinerate
    5. Send to landfill
2. RIGID MATERIALS. These materials are made by one polymer and are very sturdy, such as a plastic soda bottle or a yogurt container. These are options for the waste stream (1 is most desirable, 5 is least):
    1. Reuse the material for the same use, such as using a soda bottle to hold vermicompost or reusing a glass milk jar to hold water.
    2. Dissemble/Recycle it (melt the polymers and recycle them, like we do with our soda bottles today)
    3. Incinerate
    4. Send to landfill
3. COMPLEX HYBRID MATERIALS. These materials are made by more than one polymer, causing multiple waste streams. These are options for the waste stream (1 is most desirable, 5 is least):
    1. Upcycle/reuse: Re-purpose the product into a value added product (such as turning old eye glasses into a chandelier).
    2. Incineration
    3. Send to landfill



DAY 3

WHERE DOES OUR "WASTE" FIT IN THE HIERARCHY?

1. Introduce and discuss the second Habit of a Systems Thinker:



2. Back in their groups, students use the hierarchy to sort their lists of school-made and home-made waste, placing them in the appropriate hierarchy categories.

3. A class visual of the Hierarchy of Waste is created, incorporating and showcasing all of the work of each small group. Duplicates should be eliminated and questions addressed, leaving a visual representation of the hierarchy that is populated with the actual examples from school and home.

4. At the end of the experience, students reflect on themselves and their participation by considering how they "changed their perspectives to increase their understanding" as a result. This reflection should be written in a journal or kept as a formative assessment.

DAY 4 (& 5, IF NEEDED)

WHAT DO WE DO WITH THE STUFF THAT'S ALREADY IN THE SYSTEM?

1. Introduce the third Habit of a Systems Thinker:

2. Students watch a short video of the TerraCycle Designers' design process.
   - http://www.youtube.com/watch?v=n-VtyvhKwaY
3. At this point, groups shift from discovery and analysis to innovation and design. As design groups, they take on the challenge of figuring out what to do with one of the pieces of trash in their hierarchy.

Groups:

a. Determine what disposed items categorized in the lower two parts of the hierarchy would have the greatest affect on eliminating "waste" if it could be moved up to one of the top two categories of the hierarchy.
b. Decide which of those items could be turned into something that people would value.
c. Further narrow their list by considering how creating this new use would contribute to eliminating waste.

4. Each group provides either an illustration or prototype of their idea, a written description that includes a rationale (Why is it important for us to eliminate the chosen "waste" from the hierarchy? What will happen if we don't do something to eliminate this as "waste"?), and explanation of how the innovation will create something of value from something that people discard as trash. (To add authenticity, you could send these illustrations or proto types, or the proposals to TerraCycle for review, feedback or inclusion on their website.)

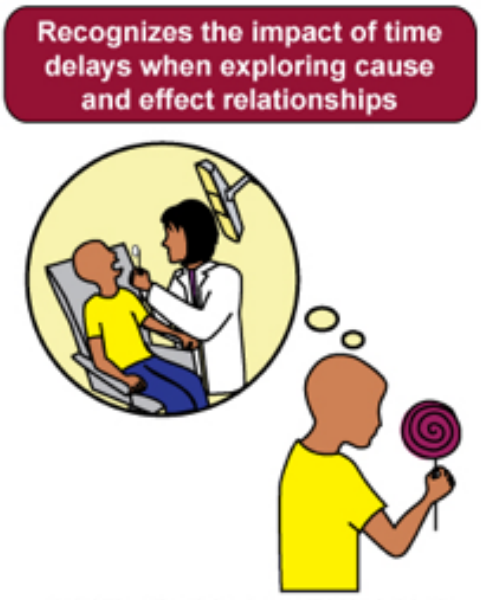
5. Individually, students review the semantic maps that they created at the beginning of this lesson set. They revise them based on what they now know, believe and practice.

6. End of lesson reflection:
   a. What have you learned about yourself, about others and about "waste"?
   b. Describe yourself using the habits of a systems thinker that we have learned about. Which habit is your strongest? Which do you still need to work on? What did you do in the past 4 or 5 days that makes you think this?
   c. What will it take to eliminate the word "waste" from our vocabulary? What can we do to help make this happen? Why is it important?

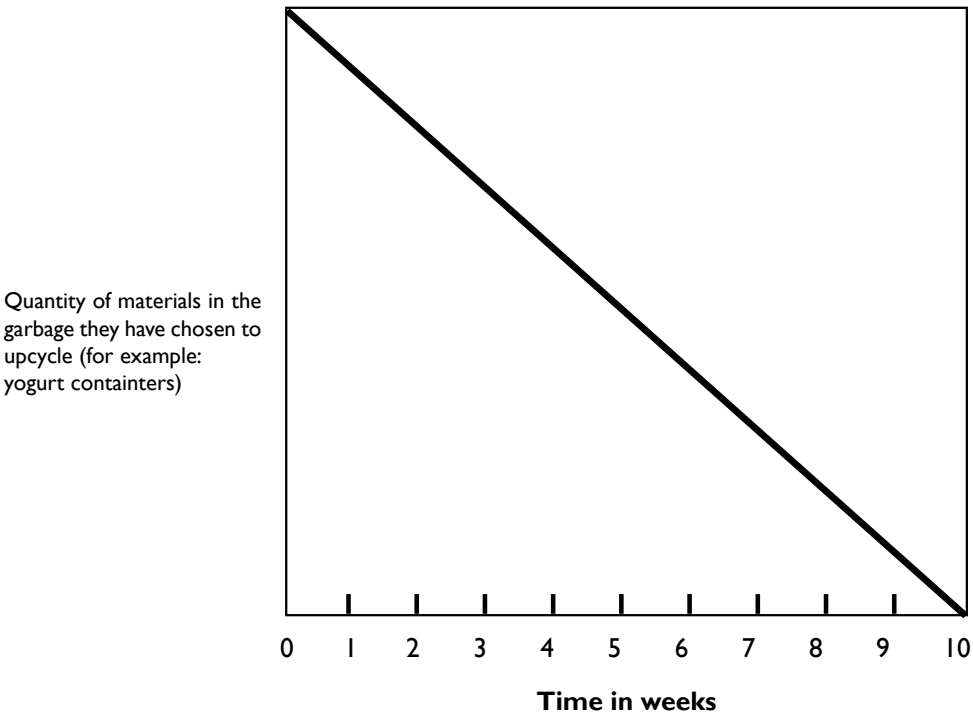
Note to teachers: If you decide to use the extension below, wait until after it is complete to address 5 & 6 above. The end of lesson reflection is very important. Use some or all of the questions and scaffold as needed based on your students' abilities and experience with reflection.

Extension - Why does a "no waste" world matter?

1. Review the fourth Habit of a Systems Thinker:



2. Design groups create a proposal that is presented to the entire class, along with the illustration or prototype. The class votes on the plan that it will put its energies behind, collects the waste that is now a resource, and completes the design.
3. Class designs and implements a study over a period of time to see if their innovation actually moves up in the hierarchy in school and/or at home, and therefore is rarely found or not found at all in trash bins. They can use a Behavior Over Time Graph to illustrate how successful they have been.



EfS Assessment/Scoring Criteria

What do I need to collect or administer to prove that students have grown towards and/or achieved desired outcomes/standards?

EfS/Common Core Standards	EfS Indicators/ National Benchmarks	Assessment Instrument	EfS/ State Scoring Criteria
Dynamics of Systems and Change	C5	Lesson Reflections	Be able to illustrate that what we see happening around us depends on where we are in the system (perspective consciousness).
	C17	Class Discussions and Innovation Description Extension: Behavior over time graph	Make choices and decisions and takes action (s) that maximize the health of the whole system upon which the specific part (s) depend (s).
	C30	Use of hierarchy in decision making	Demonstrate that cause and effects are not closely related in time and space in a system (there are delays in systems).
	C39	Semantic Map	Determine which leverage points have the greatest impact and which have the least so that they can identify where to intervene in the system(s) for the best possible impact on the system(s) consistent with the stated goal(s).
	C46 C47	Day 3 Reflections	Change perspective to increase their understanding of the system. Recognize/identify how mental models and paradigms affect current reality and create our futures.
Natural Laws and Ecological Principles	F7e	Rationale Statement	Make a case for why global citizens should understand the basic natural laws and principles including: materials cycle.
Sense of Place	I26	Innovation Description	Build a model of a green school as a prototype for their school.

EfS/ Common Core Standards	EfS Indicators/ National Benchmarks	Assessment Instrument	EfS/ State Scoring Criteria
Common Core ELA Writing	Text Types and Purposes	Lesson reflections Innovation description	**Grade 3 Students can:** 2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly. a. Introduce a topic and group related information together; include illustrations when useful to aiding comprehension. b. Develop the topic with facts, definitions, and details. c. Use linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information. d. Provide a concluding statement or section related to the information or explanation presented. 7. Conduct short research projects that build knowledge about a topic 8. Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
	Research to Build and Present Knowledge	Gathering and documenting "waste"	
	Text Types and Purposes	Lesson Reflections Innovation description	**Grade 4 Students can:** 2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly. a. Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension. b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic. c. Link ideas within categories of information using words and phrases (e.g., another, for example, also, because). d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Provide a concluding statement or section related to the information or explanation presented. 7. Conduct short research projects that build knowledge through investigation of different aspects of a topic. 8. Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
	Research to Build and Present Knowledge	Gathering and documenting "waste"	
	Text Types and Purposes	Lesson reflections Innovation description	**Grade 5 Students can:** 2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly. a. Introduce a topic clearly, provide a general observation and focus, and group related information logically; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension. b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic. c. Link ideas within and across categories of information using words, phrases, and clauses (e.g., in contrast, especially). d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Provide a concluding statement or section related to the information or explanation presented. 7. Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. 8. Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
	Research to Build and Present Knowledge	Gathering and documenting "waste"	

EfS/Common Core Standards	EfS Indicators/ National Benchmarks	Assessment Instrument	EfS/ State Scoring Criteria
Common Core ELA Speaking/ Listening	Comprehension/and Collaboration	Discussions and group work	**Grade 3 Students can:** 1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly. a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion. b. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion). c. Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others. d. Explain their own ideas and understanding in light of the discussion. **Grade 4 Students can:** 1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion. b. Follow agreed-upon rules for discussions and carry out assigned roles. c. Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. d. Review the key ideas expressed and explain their own ideas and understanding in light of the discussion. **Grade 5 Students can:** 1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly. b. Follow agreed-upon rules for discussions and carry out assigned roles. c. Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others. d. Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.

EfS/Common Core Standards	EfS Indicators/ National Benchmarks	Assessment Instrument	EfS/ State Scoring Criteria
Common Core ELA Language (assessment of indicators dependent upon individual teacher and curriculum)	Conventions of Standard English Knowledge of language Vocabulary Acquisition and Use	Lesson reflections, explanation of innovation	Grade 3, 4 and 5 Students can: 1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. 2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. 3. Use knowledge of language and its conventions when writing, speaking, reading, or listening. 6. Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases, including those that signal spatial and temporal relationships (e.g., After dinner that night we went looking for them).
McCREL Standards Level 3-5	Geography Standard 16		5. Knows the advantages and disadvantages of recycling and reusing different types of materials.

Habits of a Systems Thinker Sets (Cut out and provide one set per student)[2]

[2]Habits of a Systems Thinker cards ©2010 Waters Foundation, Systems Thinking in Schools.
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