

AN EXPLORATION OF CRADLE-TO-CRADLE DESIGN THINKING

Teacher's Guide

Grade: 9 -12

Lesson: An Exploration of Cradle-to-Cradle Design Thinking

Number of Class Periods: Three 45-minute periods



The TerraCycle Curriculum Series was co-created by The Cloud Institute for Sustainability Education and Learner-Centered Initiatives.



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Standards

McCrel National Standards

Health - Level IV (9-12)

Standard 2: Knows environmental and external factors that affect individual and community health

2. Knows how individuals can improve or maintain community health (e.g., becoming active in environmental and economic issues that affect health, assisting in the development of public health, policies and laws, exercising voting privileges)
3. Understand how the environment influences the health of the community (e.g., environmental issues that affect the food supply and the nutritional quality of food)

Geography – Environment and Society - Level IV (9-12)

Standard 14: Understands how human actions modify the environment

1. Understands how the concepts of synergy, feedback loops, carrying capacity and thresholds relate to the limitations of the physical environment to absorb the impacts of human activity (e.g., levee construction on a flood plain, logging in an old-growth forest, construction of golf courses in arid areas)
4. Knows how people's changing attitudes toward the environment have led to landscape changes (e.g., pressure to replace farmlands with wetlands in flood plain areas, interest in preserving wilderness areas, support for the concept of historic preservation)

Language Arts - Level IV (9-12)

Standard 5: Uses the general skills and strategies of the reading process

6. Understands the philosophical assumptions and basic beliefs underlying an author's work (e.g., point of view, attitude, and values conveyed by specific language; clarity and consistency of political assumptions)

Standard 8: Uses listening and speaking strategies for different purposes.

1. Uses criteria to evaluate own and others' effectiveness in group discussions and formal presentations (e.g., accuracy, relevance, and organization of information; clarity of delivery; relationships among purpose, audience, and content; types of arguments used; effectiveness of own contributions)
2. Asks questions as a way to broaden and enrich classroom discussions

Standard 9: Uses viewing skills and strategies to understand and interpret visual media

1. Uses a range of strategies to interpret visual media (e.g., draws conclusions, makes generalizations, synthesizes materials viewed, refers to images or information in visual media to support point of view, deconstructs media to determine the main idea)

ENDURING UNDERSTANDINGS

- EU1 – A healthy and sustainable future is possible
- EU8 – Think 1,000 years
- EU11 – Live by the natural laws

LESSON SUMMARY

Students explore beliefs, strategies and actions related to the concept of Cradle to Cradle design, and make connections to their lives. They share their response to the question, **“Why is it important for global citizens to understand the basic natural laws and principles?”** during a formal Socratic Seminar discussion, supporting their responses with information from the following resources:

- The NEXT Industrial Revolution (William McDonough and Michael Braungart, The Atlantic Monthly, October 1998)
- A TedTalk by William McDonough on Cradle to Cradle design
- Earth Basics for Sustainable Living, adapted from The Natural Step (www.naturalstep.org)
- Biography Of TerraCycle Founder CEO Tom Szaky

OVERARCHING QUESTION

Why is it important for global citizens to understand the basic natural laws and principle?

GUIDING QUESTIONS (these questions can be provided to students as scaffolds, or can be used as individual assessment opportunities, as appropriate)

WHAT DOES ECO-EFFICIENCY REFER TO? HOW DOES THIS APPLY TO TODAY’S INDUSTRIES? (EU 8)

WHAT IS “CRADLE TO CRADLE” DESIGN? HOW DOES CRADLE TO CRADLE DESIGN SUPPORT ALL SPECIES? (EU 1, 8)

HOW COULD EARTH BASICS PLAY OUT IN OUR LIVES? (EU 11)

WHAT CAN BE LEARNED FROM THE LIFE AND WORK OF TOM SZAKY? (EU 1, 8, 11)

WHY DO WE HAVE TO LIVE BY THE NATURAL LAWS AND PRINCIPLES? (EU 11)

WHAT WILL IT TAKE TO GET TO MCDONOUGH’S INTENTION OF LOVING ALL CHILDREN OF ALL SPECIES ALL THE TIME? (EU 1)

Resources/materials for this lesson:

- The NEXT Industrial Revolution (William McDonough and Michael Braungart, The Atlantic Monthly, October 1998)
- A TedTalk by William McDonough on Cradle to Cradle Design (www.ted.com/talks/william_mcdonough_on_cradle_to_cradle_design.html)
- Earth Basics for Sustainable Living, adapted from The Natural Step (www.naturalstep.org)
- Biography Of Terracycle Founder CEO Tom Szaky,
- Discussion Rubric
- Material Cycle Hierarchy
- Gyre Animation: <http://www.team847.com/media/animations/2010-animation-operation-gyre>
- Water Animation: <http://www.team847.com/media/animations/2009-animation-purewater-847>
- Material Hierarchy: one page description

LEARNING OPPORTUNITIES, ACTIVITIES, AND PROCEDURES

DAY 1

Review the overarching question, “Why is it important for global citizens to understand the basic natural laws and principles?”

1. Have students respond to this question in writing or through a graphic representation.
2. Moving, round robin around the classroom, allow each student to make one statement about the overarching question. Students should listen carefully to these statements to find those that are most compatible with – or provide the best challenge for – their own ideas, as they will be able to choose a partner to prepare with for the Socratic seminar.
3. Introduce or review the Socratic Seminar Basics with students and hand out the discussion rubric. Provide time for students to ask questions.
4. Have students select a working partner.
5. Allow new partners to generate several belief statements and questions related to the overarching question.

DAY 2

1. Provide copies of all print selections, and access to TedTalk. With the overarching question in mind, allow students to begin to read and discuss in partner groups.
2. In partners, students work with the selections, taking notes and making connections to the statements and questions they generated yesterday. They read and discuss the selections as they support the overarching question, identifying and documenting key sections to support (or stretch) their ideas, and keeping track of their questions, insights and ideas as they work with each selection.

DAY 3

1. Participate in Socratic Seminar.
2. Partners self and peer assess.
3. Students revisit their initial response to the overarching question, and revise their response to reflect new understanding, questions or insights.

INSTRUCTIONAL/ENVIRONMENTAL MODIFICATIONS/DIFFERENTIATED STRATEGIES

Students for whom the level of difficulty of the reading precludes them from being able to engage with it should either read in small groups with the teacher, scaffolding understanding with frequent questions or explanations, or read aloud with their partner and question the text as needed.

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/NATIONAL STANDARD	EFS/NATIONAL PERFORMANCE INDICATOR (LETTER AND NUMBER)	ASSESSMENT INSTRUMENT	SCORING CRITERIA
F Natural Laws and Ecological Principles	7	Pre/post response to essential question	Student responses will make a case for the importance of global citizens understanding the basic natural laws and principles
H Multiple Perspectives	H7	Participation in Socratic Seminar	Discussion Rubric (Social Interaction dimension)
H Multiple Perspectives	H11	Participation in Socratic Seminar	Discussion rubric (Behavior/Control dimension)
Health	2.2	Pre/post response Participation in Socratic Seminar	Responses indicate how individuals can improve or maintain community health Responses include the influences the environment has on the health of the community (e.g., environmental issues that affect the food supply and the nutritional quality of food)
Health	2.3	Pre/post response Participation in Socratic Seminar	Understand how the environment influences the health of the community (e.g., environmental issues that affect the food supply and the nutritional quality of food)

Health Level IV Standard 2	2	Pre/post response Participation in Socratic Seminar	Responses indicate how individuals can improve or maintain community health
	3	Pre/post response Participation in Socratic Seminar	Responses include the influences the environment has on the health of the community (e.g., environmental issues that affect the food supply and the nutritional quality of food)
Geography Level IV Standard 14	1	Pre/post response to essential question Participation in Socratic Seminar	Student responses indicate understanding of how the concepts of synergy, feedback loops, carrying capacity and thresholds relate to the limitations of the physical environment to absorb the impacts of human activity
	4	Pre/post response to es- sential question Participation in Socratic Seminar	Students explain how people's changing attitudes toward the environment have led to landscape changes
Language Arts Level IV Standard 5	6	Participation in Socratic Seminar	Students can express their ideas about the philosophical assumptions and basic beliefs underlying an author's work
Language Arts Level IV Standard 8	1	Participation in Socratic Seminar	Students use criteria to evaluate own and others' effectiveness in group discussions and formal presentations
	2	Discussions, if any, re- lated to comprehension and value of each text prior to Socratic seminar Participation in Socratic Seminar	Students ask questions as a way to broaden and enrich classroom discussions
Language Arts Level IV Standard 9	1	Discussions, if any, re- lated to comprehension and value of the TedTalk prior to Socratic seminar Participation in Socratic Seminar	Students exhibit the ability to interpret visual media

Note to teachers: Student acquisition of enduring understandings can be monitored through responses to questions identified by (EU).

MATERIAL CYCLE HIERARCHY

Reference: Tom Szaky (C.E.O. of TerraCycle)

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):

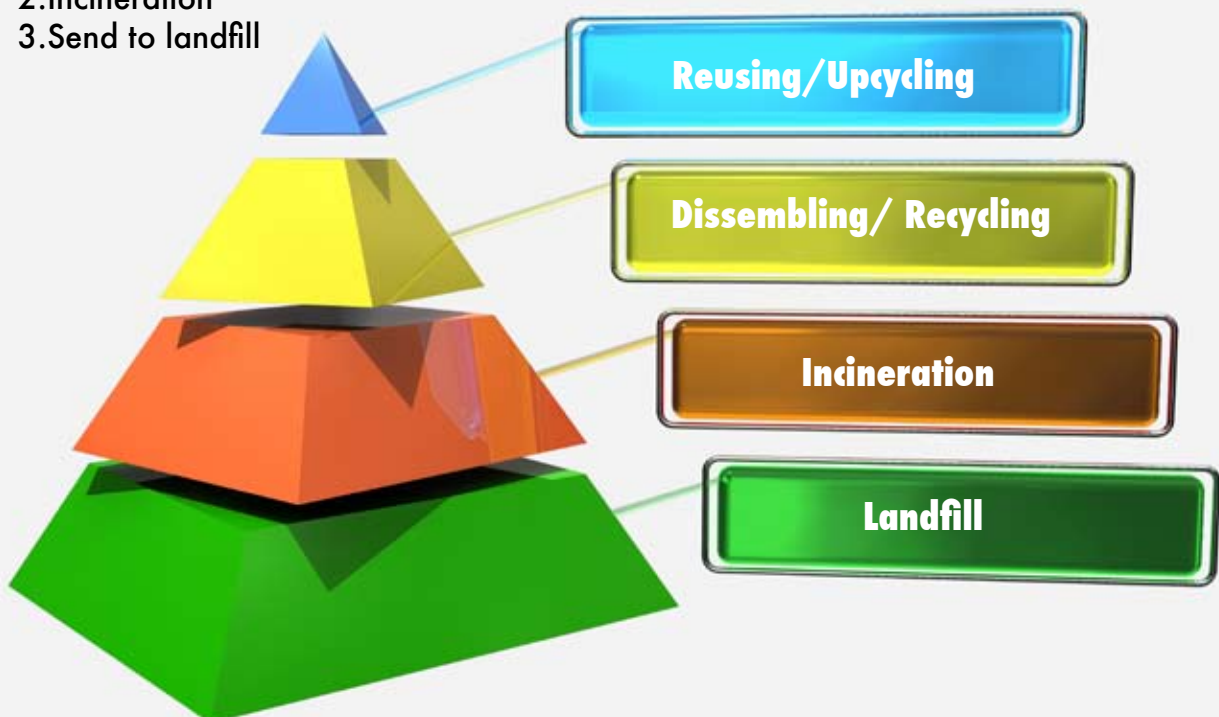
1. Upcycling adds value by using the material as (e.g. using candy wrappers to make a tote bag)
2. Reuse (for instance using a yogurt cup and making into a planter)
3. Disassemble/recycle – creating plastic pellets – to use as plastics
4. Incinerate
5. Send to landfill

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. Disassemble/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 eyeglasses into a chandelier).
2. Incineration
3. Send to landfill





SOCRATIC SEMINAR BASICS

1. Pose a **BIG QUESTION** (or a series of questions) that can be discussed by using the text as support. These are not content questions but should generally be questions requiring analysis, synthesis or evaluation.
2. Allow students time to read selection(s), aware of the question(s). They should be prompted to answer the question(s), referring to specific places in the text for support (references should be by line number or page number and paragraph). This can be a homework assignment or done in class.
3. Once students have read the selections and established their answers and support, the seminar begins.
4. A facilitator for the group is selected (this can be the teacher or, once the students are comfortable with the process, it can be a student). The facilitator is responsible for maintaining the focus of the seminar, stopping side conversations, reminding participants to give the supporting evidence, ensuring appropriate participation)
5. In a circle, students share responses:

- One person begins and others add to, agree with additional support or disagree with support.
- Participants should use each other's names when responding and refer to the content of what was said previously.

Example: "I agree with Alicia that...and I'd like to add...this can also be seen on page... [student reads supporting section from text]" or "I disagree with Terence when he says... [student states own point of view]...This can be seen on page...[student reads supporting section from text]"

- The order of participation is random. Students can speak when they have something to add to the conversation, provided they don't interrupt or talk over someone else (while raising hands isn't recommended, it is a difficult habit to break and might require practice).
 - Repetition should be discouraged.
6. Leave time at the end of the seminar to ask if there is anything that anyone would like to add to the discussion, drawing in students who haven't yet participated. The facilitator should try to sum up the conversation if possible.
 7. Finally, debrief the experience with the students. Ask what they thought of their seminar – what they felt went well, what they learned (both about the topic and about this kind of conversation), what didn't seem to work or felt awkward, what they should try to do differently next time. Let them set goals for their next seminar and remind them of those goals before beginning the next experience.

DISCUSSION RUBRIC

Adapted from rubric developed by Rich Hinrichs, © CSETL, 2001

Dimension		4	3	2	1
Social Interaction How student participates in the discussion	<ul style="list-style-type: none"> Initiates interaction among group members without monopolizing the floor. Voices opinions clearly and politely and displays grace and tact in dealing with differing views. 	<ul style="list-style-type: none"> Active, independent participant. Voices opinion politely and is tolerant of differing views. 	<ul style="list-style-type: none"> Participates when prompted teacher or peers. Voices opinion and acknowledges differing points of view. 	<ul style="list-style-type: none"> Does not engage in discussion. Appears intolerant of opposing views. 	
Discussion Content The extent to which information included is accurate, relevant and supported	<ul style="list-style-type: none"> Contributions to discussion include accurate, relevant and important information, evidencing a deep understanding of issues/topic. Strategic citing of documents enriches and develops ideas and/or opinions expressed. 	<ul style="list-style-type: none"> Contributions to discussion include accurate, relevant and important information, evidencing understanding of issue or topic. Consistent citation of documents supports ideas and/or opinions expressed. 	<ul style="list-style-type: none"> Contributions to discussion include a combination of accurate and inaccurate information, or incomplete information, evidencing some confusion related to issue or topic. Inconsistent citation of documents relate to ideas and/or opinions expressed. 	<ul style="list-style-type: none"> Contributions to discussion include inaccurate or irrelevant information, evidencing serious misunderstanding of issue or topic. Ideas and/or opinions, if expressed, are done so without citations of documents in support. 	
Behavior/ Control How student behaves during the discussion	<ul style="list-style-type: none"> Displays appreciation and open-mindedness to others' ideas/opinions. Is consistently self-controlled and self-disciplined; provides a model for other students' behavior. 	<ul style="list-style-type: none"> Accepts that there are other valid ideas and/or opinions besides own. Is respectful and follows established guidelines. 	<ul style="list-style-type: none"> Recognizes other ideas/points of view may exist, but sees them as less valid than own. May need reminders to maintain respectful participation and/or follow established guidelines. 	<ul style="list-style-type: none"> Unable or unwilling to consider different ideas/points of view. Exhibits overtly disruptive behavior – argues and/or is disrespectful to others; ignores established guidelines and/or withdraws from all participation. 	