

HOW CAN TEACHERS UTILIZE A CURRICULUM TO EXPAND STUDENTS'  
KNOWLEDGE OF WASTE MANAGEMENT AND CHANGE THEIR WASTE  
REDUCTION BEHAVIORS?

By

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## Project Summary

Growing up I never thought about where my trash went after I placed it on the curb for pickup. Now that I work as an environmental scientist for the North Dakota Department of Environmental Quality, I have seen how important it is to not only understand waste management, but to also understand how we can positively impact it through waste reduction and recycling. Using my professional career as a starting point for my capstone project, I came up with the research question: *How can teachers utilize a curriculum to expand student's knowledge of waste management and change their waste reduction behaviors?*

My goal was to create a curriculum that combined waste management and waste reduction, with a local focus on waste management and reduction in North Dakota. While the curriculum has a focus on North Dakota, educators from different states can still use the curriculum. These educators will need to replace the North Dakota information, such as municipal solid waste landfill facilities or recycling informational sheets, with information that can be found for their state. Most of this information will be found through city websites or the state's solid waste management programs.

With the focus in North Dakota, I wanted to ensure that the curriculum would meet the North Dakota educational standards, and all content standards referenced in the curriculum are North Dakota education standards from the North Dakota Department of Public Instruction. When I first started my project, I originally intended for my audience to be sixth-grade students, as I have used the candy landfill activity during our Earth Day Festival sixth-grade educational event. After looking through the educational standards, I found that the science and social studies standards covered all middle school grades, and

switched my intended audience to middle school students. This will allow for the curriculum to be seen by a more diverse audience, while still meeting my original goal.

This unit starts with an introductory lesson on waste and natural resources, before first diving into waste management. While there are many aspects of waste management, I chose to focus on landfills, as that is how a majority of waste is managed in the state of North Dakota. While a field trip to a municipal solid waste (MSW) landfill, a landfill that takes household garbage, would be beneficial for students, I decided to use it as an extension of the lesson option. As North Dakota only has 13 permitted MSW landfills, many cities and towns would not be located close enough for a field trip.

After lessons on waste management, the curriculum then changes its focus to waste reduction. While I wanted students to understand how to properly manage waste, the ultimate goal of the curriculum is to promote waste reduction and recycling in their daily lives. Many students are not exposed to recycling in North Dakota, as we are just starting to implement community recycling programs, and many recyclers that were present in the state before this were private recycling companies located in our larger cities.

These lessons were written to cover one class period, unless otherwise stated in the lesson plan. These lessons can be lengthened or shortened as needed, and teachers may even use the lessons to supplement a topic that they are covering separately. While the curriculum is best utilized as a whole, teachers may also pick and choose lessons that they would like to incorporate into their classroom. Some lesson plans include worksheets or links to information and videos, to support educators in utilizing this curriculum.

My hope is that this curriculum will provide educators and students with a broad overview of waste management and reduction, and promote waste reduction and recycling in North Dakota communities. Even if it does not have a positive impact on their recycling behaviors, it will still allow students to experience and understand where their garbage is going and the impacts their waste management behaviors can have on the environment.

## LESSON 1

<b>Lesson Topic:</b> What is Waste?	
Students will be able to look at items that are found in their homes to give an introduction to waste management and reduction for future lessons. This lesson is meant to serve as an introductory lesson to the waste management unit.	
<b>North Dakota Content Standard(s):</b>	
<b>MS-ESS3-1:</b> Construct a scientific explanation based on evidence for how the uneven distributions of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes.	
<b>Disciplinary Core Ideas</b>	
ESS3.A: Natural Resources: Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.	
<b>Cross Cutting Concepts</b>	<b>Science &amp; Engineering Practices</b>
<ul style="list-style-type: none"><li>● Cause and Effect</li></ul>	6. Constructing explanations and designing solutions
<b>Materials</b>	<b>Safety Concerns</b>
<ul style="list-style-type: none"><li>● Food</li><li>● Plastic wrappers</li><li>● Cans</li><li>● Cardboard</li><li>● Glass bottles</li></ul> <p>*Note that picture cards can be used in place of actual waste</p>	<ul style="list-style-type: none"><li>● Sharp objects and/or edges on waste products</li><li>● Waste cleanliness</li></ul>
<b>Opener Question</b>	
What is waste? Is waste for one person the same as waste for another person?	
<ul style="list-style-type: none"><li>● Ask students to give different examples of what they think is waste<ul style="list-style-type: none"><li>○ Can they draw different examples of waste they generate?</li></ul></li></ul>	

### **Access Prior Knowledge**

Ask students if they know where the waste from their house goes.

- Have a discussion about how most of their waste goes to landfills, and show them pictures of a landfill
  - Teachers may reach out to their local landfill manager or the North Dakota Department of Environmental Quality for pictures of their local landfill

Does it matter how much waste we send to the landfills?

### **Activity**

Explain to students that before your class starts learning about waste management and waste reduction, we are going to look at what waste is.

\*This activity can either be done as a class or students can be broken up into smaller groups with a class discussion at the end.

Empty your pre-prepared waste items, or picture cards of waste, out on a table(s). Ask students if they know where the materials that made their waste came from, and what resources it took to get them there. Explain that many of the items are made from natural resources.

Ask the students to sort their wastes into 2 piles: waste from renewable resources and waste from nonrenewable resources.

- What happens if most people throw items from nonrenewable resources into landfills instead of recycling?
- What about all the resources that are needed to transport the materials?
- Are some of the plastic wrappers needed? Is there something else that could be used instead?
- What about all the other resources (gas, electricity, etc.) that it took to get their waste there? Are those renewable or nonrenewable?

### **Extension**

Have students take home a Trash Bingo card, and have them fill out the bingo card with products that they throw away in their trash. Products should be placed in the appropriate natural resource category box.

### **Assessment**

Students should have a broad understanding of waste and the natural resources that are involved in making, packaging, shipping, and getting the product to them.

# Student Handout

Name: \_\_\_\_\_

## Trash Bingo



Animals	Fossil Fuels	Metals	<b>S</b>	Sand
Plants/Trees	Metals	Metals	Sand	Fossil Fuels
Fossil Fuels	<b>R</b>	<b>A</b>	Plants/Trees	Sand
<b>T</b>	Animals	Sand	Plants/Trees	<b>H</b>
Plants/Trees	Fossil Fuels	Fossil Fuels	Metals	Metals



<b>T</b>	Animals	Metals	Fossil Fuels	Fossil Fuels
Sand	Plants/Trees	<b>A</b>	Metals	Sand
Animals	Metals	Metals	Fossil Fuels	Plants/Trees
Plants/Trees	Sand	Sand	<b>S</b>	Plants/Trees
Fossil Fuels	<b>R</b>	Plants/Trees	Fossil Fuels	<b>H</b>

## Trash Bingo



Name: \_\_\_\_\_

## LESSON 2

<b>Lesson Topic:</b> Landfills	
Students will be able to look at landfills and see how they are constructed and used to dispose of their waste.	
<b>North Dakota Content Standard(s):</b>	
<b>MS-ET1-1:</b> Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	
<b>Disciplinary Core Ideas</b>	
<b>ET1.A:</b> Defining and Delimiting Engineering Problems: The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.	
<b>Cross Cutting Concepts</b>	<b>Science &amp; Engineering Practices</b>
<ul style="list-style-type: none"><li>• Systems and System Models</li></ul>	1. Asking Questions and Defining Problems
<b>Materials</b>	<b>Safety Concerns</b>
<ul style="list-style-type: none"><li>• 8 oz cups (clear)</li><li>• 5 Oreos per student</li><li>• 1 Fruit roll-up per student</li><li>• 2 graham crackers per student</li><li>• 2 licorice sticks per student</li><li>• 1 birthday candle</li><li>• Matches</li><li>• Pudding (1 cup can be shared between 2 students)</li><li>• Small chewable candies (chocolate, peanut butter, fruit)</li></ul>	<ul style="list-style-type: none"><li>• Food allergies</li></ul>
<b>Opener Question</b>	
What is a landfill?	



### **Access Prior Knowledge**

Remind students that most wastes are taken to their local landfills.

### **New Information**

Can you just dig a hole in the ground and throw your waste in it?

- Why or why not?
- Could this impact you or others?
- Would it impact the environment? (water, soil, etc.)

Have a group discussion and explain to students that landfills need to be constructed a certain way to ensure that it doesn't impact the environment and people's health.

### **Apply**

Students will construct a mini landfill made out of candy!

The landfill will be built from the bottom to the top.

1. Give each student an 8 oz. cup and 5 Oreo cookies. Explain to your students that their cup is the hole that is dug in the ground for the landfill.
2. Have students take apart 2 of the cookies, so that one half has the cream and the other half is bare. Students should crush the bare halves into small pieces and put them into their cups. These cookies will represent the soil.
3. Have students take the other cookie halves with cream on them, and break them up into bigger pieces. These should be placed in the cup with the cream facing up. These cookies represent the clay that is compacted at the bottom of the hole.
4. Next students will place their fruit rollups in their cups. Fruit rollups may either be cut to fit or just placed in. It is okay for the candy to come up the side of the cup. This candy represents the plastic liner that is placed in the landfill to prevent leachate from escaping into the ground. Leachate is liquid created when trash decomposes.
5. Next, students will crush up their graham crackers and place them in the cup. This represents the sand layer that is used as a drainage layer above the plastic liner.
6. Have students rip or bite their licorice into pieces and place the pieces in the graham crackers. These will represent the leachate pipes. These pipes collect the leachate that collects on the liners.
7. Have the students sprinkle some of their candies on top of the sand layer. These candies will represent the waste that is placed in the landfill.
8. Next place a scoop of pudding on top of the waste and then one more layer of candies. The pudding represents the seepage of rain into a landfill, which eventually turns into leachate when the waste decomposes.
9. Have students take apart 2 of their Oreo cookies, and crush the bare halves into smaller pieces and place in their landfill. These cookies represent the soil that is

placed on top of the landfill to close it.

10. In your candy landfill, stick a candle deep into the layers and light it. Explain to the students that the candle represents the methane gas and its recovery system.
11. Let students enjoy their landfills, but ask them to note whether their cookies on the bottom of their landfill are soggy or dry.

\*Note that candy/items and steps in the landfill cup can be exchanged out so long as they serve the same purpose.

### **Assessment**

After students have constructed their landfill, have a group discussion on the following:

- Did anyone have “leachate” leak through their liners? Why?
- What would happen if your liners were not properly constructed?
  - Would this be a problem if the liners in a real landfill weren’t constructed properly
- Ask students if they remember what the different candies represented in their landfills.
- What happens if your cup fills up? Is there a way to reduce the amount of waste in your landfill?
- Can we use the methane created by a landfill for energy?

### **Extension**

After completing this lesson on landfills, contact a local Municipal Solid Waste (MSW) landfill to request a tour for your classroom. North Dakota’s permitted MSW landfills can be found at this link:

<https://deq.nd.gov/Publications/WM/MunicipalSolidWasteFacilities.pdf>. If a MSW landfill is not located close to your town, you may want to consider visiting your town’s local inert (construction and demolition waste) landfill or transfer station (collects household garbage and then transfers it to a MSW landfill) instead.

### LESSON 3

<b>Lesson Topic:</b> Types of Landfills in North Dakota	
Students will be able to look at different landfills that can be found in North Dakota, and understand why different waste types need different landfills.	
<b>North Dakota Content Standard(s):</b>	
<b>MS-ESS3-1:</b> Construct a scientific explanation based on evidence for how the uneven distributions of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes.	
<b>MS-ET1-2:</b> Evaluate competing design solutions using systematic process to determine how well they meet the criteria and constraints of the problem.	
<b>Disciplinary Core Ideas</b>	
<b>ESS3.A:</b> Natural Resources: Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.	
<b>ET1.B:</b> Developing Possible Solutions: There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	
<b>Cross Cutting Concepts</b> <ul style="list-style-type: none"><li>● Cause and Effect</li></ul>	<b>Science &amp; Engineering Practices</b>  6. Constructing explanations and designing solutions  8. Obtaining, evaluating, and communicating information
<b>Materials</b> <ul style="list-style-type: none"><li>● Poster Boards (for those that would like to use)</li><li>● Markers</li><li>● Pencils</li></ul>	<b>Safety Concerns</b>  N/A
<b>Opener Question</b>	
Are there different kinds of wastes?	

### **Access Prior Knowledge**

Ask students if they think all waste can be treated the same, why or why not?

What are some different items that could be waste that doesn't go to a Municipal Solid Waste (MSW) landfill?

- Note that this is the type of landfill that takes household trash, and is the same as the one that was built in the candy landfill activity

### **New Information**

Explain to students that there are four different kinds of landfills in North Dakota:

- Inert Waste: takes construction and demolition debris
- Municipal Solid Waste: takes household garbage
- Industrial Waste: takes commercial and industrial waste
- Special Waste: these landfills take special waste.
  - North Dakota has 2 types of special waste landfills - oilfield special waste and special waste landfills for power plants that generate their own waste

North Dakota has no hazardous waste landfills.

### **Apply**

Split students into 5 groups.

Assign each group one of the following:

1. Inert
2. MSW
3. Industrial
4. CCR/Power Plant Special
5. Oilfield Special

Have each group research their assigned landfill type and make a presentation (Powerpoint, Poster Board, etc.) to teach the other students about their landfill. Students should cover:

- What types of waste the landfill takes
- Who can use the landfill
- How many of these landfills are located in the state (this information can be found on the North Dakota Department of Environmental Quality's website)
- Are there any special considerations for these landfills?
- Have each group find the closest landfill of their assigned type and end their presentation with a short overview of this landfill
  - Inert Facility List: [Inert Waste Landfills](#) & [Permit by Rule Landfills](#)

- Note that a Permit by Rule landfill is an inert landfill, but does not need to go through the permitting process
- MSW Facility List: [Municipal Solid Waste Landfills](#)
- Industrial Facility List: [Industrial Waste Landfills](#)
- Special Waste Landfills: [Special Waste Landfills](#)
  - This list includes both the CCR/Power Plant & Oilfield Special waste landfills

Students should be given at least 2 class sessions to research their landfills and 1 class session to finish their presentations. More time may be allowed if it is needed.

### **Assessment**

Each group should give a presentation that will allow all students to have a broad understanding of the different landfill types that can be found in North Dakota.

## LESSON 4

<b>Lesson Topic:</b> The Three Rs	
Students will be able to explore waste reduction, reuse, and recycling.	
<b>North Dakota Content Standard(s):</b>  <b>MS-ESS3-1:</b> Construct a scientific explanation based on evidence for how the uneven distributions of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes.	
<b>Disciplinary Core Ideas</b>  <b>ESS3.A:</b> Natural Resources: Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.	
<b>Cross Cutting Concepts</b> <ul style="list-style-type: none"><li>● Cause and Effect</li></ul>	<b>Science &amp; Engineering Practices</b>  6. Constructing explanations and designing solutions
<b>Materials</b> <ul style="list-style-type: none"><li>● Food/food waste</li><li>● Plastic wrappers</li><li>● Cans</li><li>● Cardboard</li><li>● Paper</li><li>● Plastic bags</li><li>● Food wrappers</li><li>● Ziplock bags</li><li>● Water bottles</li></ul> <p>*Note that picture cards can be used in place of actual waste</p>	<b>Safety Concerns</b> <ul style="list-style-type: none"><li>● Sharp objects and/or edges on waste products</li><li>● Waste cleanliness</li></ul>
<b>Opener Question</b>  What are the three Rs?	
<b>Access Prior Knowledge</b>  Explain to students that the three Rs of recycling are: Reduce, Reuse, & Recycle.	

Ask students if they do any activities in their house to reduce their waste, reuse items, or if their families recycle.

### **Activity**

\*This activity can either be done as a class or students can be broken up into smaller groups with a class discussion at the end.

Empty your pre-prepared waste items, or picture cards of waste, out on a table(s). Ask the students if all the items are waste. Can some of these items be reused or be disposed of somewhere besides a landfill?

Ask students to sort their wastes into 4 piles: reuse, recycle, reduce, landfill

- Why did they place the items in the piles they did?
- Is there a way to reduce the landfill pile? (Ensure that food packaging and grocery bags are included in your pre-prepared waste items)
- Do any students or their family already work to limit their packaging and grocery bag waste?
- Why do students think it's important to reduce their landfill waste?
- What happens if items that need to go to the landfill end up in the recycling pile?

### **Extension**

Have students take home the 3 Rs activity sheet and see if they can find activities or items in their house where their family reduced, reused, or recycled waste instead of throwing it away.

If they can't find any, can they find ways to incorporate the 3 Rs into their daily lives.

\*Note that some families may not use the 3 Rs, and students should not get a lower grade due to this. Students instead may write that all their waste goes in the trash.

### **Assessment**

Students should be able to define the three Rs and how they can use them in their everyday lives.





## LESSON 5

<b>Lesson Topic:</b> Composting	
Students will be able to look at composting and see how different materials may or may not decompose. Students should already be familiar with the decomposition process.	
<b>North Dakota Content Standard(s):</b>	
<b>MS-ET1-3:</b> Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	
<b>MS-ET1-4:</b> Develop a model to generate data from iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	
<b>G.6_12.5:</b> Analyze how human beings are dependent upon, adapt to, and modify their environment to meet their needs	
<b>Disciplinary Core Ideas</b>	
<b>ET1.B:</b> Developing Possible Solutions: A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. Models of all kinds are important for testing solutions.	
<b>ET1.C:</b> Optimizing the Design Solutions: The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.	
<b>G.6_12.5.2:</b> Analyze how human changes to the environment in one region or place can affect another.	
<b>Cross Cutting Concepts</b> <ul style="list-style-type: none"><li>● Cause and Effect</li></ul>	<b>Science &amp; Engineering Practices</b> 6. Constructing explanations and designing solutions
<b>Materials</b> <ul style="list-style-type: none"><li>● 5 Gallon Bucket(s) with lid</li><li>● trowel/spade</li><li>● Tarp</li><li>● 1 gallon of compost or soil<ul style="list-style-type: none"><li>○ Will need more if you would like to compost in multiple buckets</li></ul></li></ul>	<b>Safety Concerns</b>

- Compostable materials (food materials may be easiest)
- Non-compostable materials
- Water
- Sawdust, dried leaves, or other “browns material” for composting (Browns)
- Grass clippings or food waste (Greens)

### **Opener Question**

How does nature recycle?

### **Access Prior Knowledge**

Explain to students that nature recycles by decomposition, and we use this process to recycle our food waste through composting.

\*A refresher on the decomposition process may be needed prior to this activity.

Ask if any of the students compost or have composted before.

- What kind of items do they put in their compost pile?
- What do they use the finished compost for?

### **Activity**

Explain to students that you will be composting in class to compare how different materials may or may not decompose in a composting pile.

Students should collect different waste materials to add to the compost bucket and bring them to class prior to the activity.

Explain to students how a compost pile is built. Please reference [Composting in your backyard \(nd.gov\)](http://www.nd.gov) for more information. If a compost pile is not built properly, they can get odors, it won't decompose properly, or it may catch on fire.

1. Collect a small quantity of non-compostable materials to include in the pile for observation.
2. With the trowel or spade, chop the food and other compostable materials into small pieces.
  - a. Smaller pieces will make the decomposition process go faster
  - b. Larger pieces can be left in to compare the composting process
3. Fill the bucket half full with your greens and browns. Layer and mix them as you go. Include your non-compostable materials in the layers.
  - a. Greens will be your food waste or other compostable materials the class

collected

- b. If you are worried about odors, placing more browns in the bucket could ensure they are avoided. This will limit how fast the compost heats up.
4. Add water as needed to keep the pile moist, but not completely wet.
5. Record items that go into the bucket. This can be completed on the worksheet or on a whiteboard/chalkboard.
6. Add the soil or compost to the bucket. Ensure your bucket is no more than  $\frac{3}{4}$  full.
7. Keep your compost materials moist.
8. Have your students write their predictions about what will happen to the contents of the bucket and the items that were placed in the bucket.
  - a. Will it smell bad?
  - b. Will it decay?
  - c. Will things grow?
  - d. What will happen to the food waste?
  - e. What will happen to the plastic materials?

After students have recorded their predictions, the bucket can be sealed and then maintained until the end of 2-4 weeks.

#### Composting maintenance

- Every few days, open up the bucket to mix and water the contents (ensuring you keep the items moist but not completely wet).
- A chart may be kept to record the following:
  - Temperature
  - Odor
  - Texture
  - Weight
  - Other observations

At the end of the 2-4 weeks:

1. Read the list of items that were placed in the bucket
2. Have students reread their predictions
3. Students can examine the items in the bucket.
4. On a tarp, students can take the items out and sift through the contents of the bucket.
5. Discuss the outcome with your students.
  - a. What happened?
  - b. How was it different from what they expected?
  - c. Could they change something to make the compost better?
  - d. How do they get the non-compostable materials out of their finished compost?
    - i. Could this be an issue for landfills that compost large piles?
6. Explain that with the help of bacteria and other organisms, all organic material can decompose into a rich, dark compost. This compost can make healthy soil

and can be used on lawns, gardens, or their house plants.

**Extension**

With permission from your school, start a school composting program following the guidance from [Composting in your backyard \(nd.gov\)](#). Finished compost can be used by the school for grounds maintenance, given away to students and their families, or donated to a community garden or other organization.

**Assessment**

Students should have an understanding of composting and how it can help to recycle compostable materials from their household, instead of having the items take up room in a landfill.



## LESSON 6

<b>Lesson Topic:</b> Recycling in North Dakota	
Students will be able to look at recycling and the recycling process, with a focus on recycling in North Dakota.	
<b>North Dakota Content Standard(s):</b>	
<b>MS-ET1-1:</b> Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	
<b>C.6_12.4:</b> Investigate the role and responsibilities of citizenship in society.	
<b>Disciplinary Core Ideas</b>	
<b>ET1.A:</b> Defining and Delimiting Engineering Problems: The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit the possible solutions.	
<b>C.6_12.4.5:</b> Demonstrate active participation in civic life	
<b>Cross Cutting Concepts</b> <ul style="list-style-type: none"><li>• Systems and System Models</li></ul>	<b>Science &amp; Engineering Practices</b> 1. Asking questions and defining problems
<b>Materials</b> <ul style="list-style-type: none"><li>• Local recycling informational sheets</li><li>• NDSWRA recycling bucket</li></ul>	<b>Safety Concerns</b>
<b>Opener Question</b> Does your family recycle?	
<b>Access Prior Knowledge</b> Ask students if they know if your city has a recycling program. If not, can they still recycle? How?  *You will need to do prior research to see if your city has a recycling program, whether it be curbside or drop-off.	

## Activity

Ask your students if they know where recycling goes?

Explain that today you are going to look at the recycling process, along with what happens if your recycling is not sorted properly.

The first step in the recycling process is collection of the recyclable materials. This can either be through a curbside or drop-off program. If your community has a recycling program, display informational materials for this program (see City of Bismarck [Recycling\\_Acceptable-and-Not-Acceptable-Items \(bismarcknd.gov\)](http://bismarcknd.gov)).

Ask students what happens if items that can't be recycled are placed in the recycling? This is called wishcycling. Show students this [Recycling 101: Why "wish-cycling" does more harm than good - YouTube](#) on wishcycling, and then explain that if the recycling loads are too contaminated, many of them end up having to be taken to the landfill.

Next, ask the students where all of the recycling in North Dakota goes after it's collected? Explain that after collection, recycling needs to go to a Material Recovery Facility, and that the closest is found in Minneapolis, MN. Show students this video that explains a Material Recovery Facility [Single Stream Recycling – Tour a Material Recovery Facility \(MRF\) - YouTube](#).

Ask students if they can think of any problems with having to ship all of our recycling to Minnesota. Some examples can include:

- Gas prices
- Shipping prices
- What happens if it costs more to ship down than the company makes from the recycled materials?

Do you think North Dakota could open their own Material Recovery Facility?

After the recyclables have been sorted, they are sent to different companies who use the recycled materials to manufacture products. Ask the students if they can think of anything that can be used from recycled products? Most students will list bottles, metal cans, and other plastic items. Ask the students if they think clothes can be made from plastic? Some other examples of recycled products include:

- Carpet made from plastic
- Pencils made from money
- Shower tiles made from recycled glass

\*The North Dakota Solid Waste & Recycling Association has put together a bucket of materials that have been made from recycled products, and this bucket can be checked out from libraries located in your county seat's city/town. If you would like more information on this bucket, please contact Lexi Craig with the ND Department of

Environmental Quality at 701-328-5171.

Finish the discussion on recycling by asking students if they buy products made from recycled materials. Have an open discussion and see what students think about recycled products and the process that they go through once collected.

**Assessment**

Students should have an understanding of the recycling process and how wishcycling can negatively impact a recycling load.



## FINAL PROJECT

<b>Lesson Topic:</b> Recycling in Your Community or School	
Students will be able to apply knowledge from the waste management and reduction curriculum and use it to develop a community or school waste reduction project.	
<b>North Dakota Content Standard(s):</b>  <b>MS-ET1-1:</b> Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.  <b>C.6_12.4:</b> Investigate the role and responsibilities of citizenship in society.	
<b>Disciplinary Core Ideas</b>  <b>ET1.A:</b> Defining and Delimiting Engineering Problems: The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit the possible solutions.  <b>C.6_12.4.5:</b> Demonstrate active participation in civic life	
<b>Cross Cutting Concepts</b> <ul style="list-style-type: none"><li>• Systems and System Models</li></ul>	<b>Science &amp; Engineering Practices</b> <ol style="list-style-type: none"><li>1. Asking questions and defining problems</li></ol>
<b>Materials</b> <ul style="list-style-type: none"><li>• Materials needed may vary based on the projects students come up with (and whether you will implement the project or not)</li></ul>	<b>Safety Concerns</b>
<b>Opener Question</b>  Does our school/community have a recycling program?	
<b>Access Prior Knowledge</b>  Ask students if they know if your city and/or school has a recycling program.  *You will need to do prior research to see if your city has a recycling program, whether it be curbside or drop-off.	

## **Activity**

Students will develop either a community or school recycling program (or informational/awareness program)

1. Split students into small groups (4-5 people).
2. Have students come up with a school or community recycling program, informational poster, informational session, or other project regarding recycling.
  - a. Ensure you leave the concept idea open to allow students to be creative with their project ideas
3. Students should come up with how it would be implemented, the steps it would take to implement it, and a presentation to present to the school or city on why the program should be implemented.
4. Have each group present their program to the class, and have students choose which project they would want to vote to implement.
5. After each group has presented, have a class discussion on what worked best and what could be improved when implementing a recycling program or educational program for recycling.

\*Projects may or may not be implemented depending on time, resources, and need for the program in your community and/or school.

**Note:** Students should be given at least 2-3 days of class time to research and develop their project, and then another 1-2 days of class time to put their presentations together. More time may be allowed as needed.

## **Assessment**

Students should understand the process and resources it takes to start a recycling program in your community, along with understanding that some projects are not feasible due to various restrictions that they may encounter during the project development.

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