Grade 6 *DCPS Recycle Right!* Lesson Plan

Full-Cornerstone Lesson Plan

Approximately 5+ hours of instruction

Brief Lesson Description:

The *Sustainable DC* plan sets a zero waste target for our city, with the goal of diverting 80% of our waste in large part by recycling. Within DCPS, each school is responsible for ensuring that clean paper is recycled. The *DCPS Recycle Right!* competition challenges students to investigate and improve how well their school recycles. Students will explore their schools' current recycling practices, design and implement a plan for improving recycling, collect data on the accuracy of recycling over the course of four weeks, analyze the impact of the selected solution, and propose modifications for a long-term recycling campaign to their school administration.

This set of lessons is designed to align with participation in the official *Recycle Right!* competition which can be done at any point during the school year. The lesson series provides an opportunity for students to collect real-world data while making connections to other disciplines. As data will need to be collected over the course of four weeks, other content will need to be taught concurrently with the lesson series.

There is significant flexibility in the implementation of these lessons. Class/group size and number of classes as well as the time available will significantly impact how a teacher chooses to limit the solution students can put into place and how much class time is used to implement the solution. While the set of lessons follows the engineering/design cycle, it makes an excellent class-based example of a science project and could be used to highlight the impact of one variable (solution selected) on the accuracy of recycling.

Standards listed are those for Earth & Space Sciences (6th Grade in DCPS), however both 7th and 8th grade DCPS courses have similar Engineering Design standards which are applicable and lesson materials are easily adaptable for use at those grades.

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Materials and Supplies

Your supply kit contains:

Durables (may be in your classroom already from prior years)

No durable supplies are inherently required for this set of lessons. However, it is critical that each classroom where data will be collected have both a trash can and clearly-labeled paper recycling bin. Teachers should check that these items are in place prior to lesson implementation; contact your lead custodian or business manager if this is not the case. *Note: DC Charter schools may have recycling set-ups that differ. Please check with your building's recycling point of contact.*

Consumable materials (In kit supplied by Central Office)

Item	Purpose	When used
Nitrile gloves (optional)	For students to wear during data collection	Engage and Explore

Classroom Supplies to Gather

Item	Purpose	When used
Calculators	For student use in data analysis	Explore and Explain
Chart paper (or digital equivalent)	To display class data tables	Explore and Explain
Example trash and recycling bins from actual classrooms	For initial observations	Engage
Notebook paper (or digital equivalent)	For drafting letters	Elaborate

Technology Resources to prepare

Resource and preparation required	Purpose	When used
Student lab packets	To record student work	Throughout lesson

Key Standards		
Science and Engineering Practices: **Planning and Carrying Out Investigations** Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5) (Explore) **Analyzing and Interpreting Data** Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2) (Explain) **Engaging in Argument from Evidence** Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4) (Elaborate)	**Disciplinary Core Ideas:** **Developing Possible Solutions** A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) (Explain & Elaborate) Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) (Explain & Elaborate)	**Crosscutting Concepts:** **Cause and Effect** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1) (Engage) **Scale, Proportion, and Quantity** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1- 3) (Explore) **Influence of Science, Engineering and Technology on Society and the Natural World** The uses of technologies and limitations on their use are driven by people's needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-ESS3-2),(MS-ESS3-3) (Elaborate)

Lesson Plan		
Engage (25 Min) **Daily Objective and Summary:** Students will be introduced to the *Recycle Right!* competition and make initial observations of recycling practices in classrooms at their school. After brainstorming factors affecting the accuracy of recycling practices in the school, the teacher will guide students in selecting a change in the recycling process (solution) to improve recycling accuracy. **Teacher will need:** projector, example trash and recycle bins from actual classrooms **Students will need:** student lab packet		
Teacher	**Students**	**Notes**
Whole Class (10 min) Introduce *Recycle Right!* Challenge: - Introduce Sustainable DC and the goal of reducing waste, specifically focusing on paper recycling. - Connect individual school to DCPS and entire city movement with Sustainable DC by explicitly diagraming levels of scale (classroom, school, DCPS, DC as a city) and how studying one level can provide information about a larger system. - Explain that both DGS and the school administration need more information about how to improve paper recycling. - Orally introduce key aspects of challenge: improve the amount of paper that is recycled and reduce the contamination of paper recycling - Provide an example of contamination using a food-based example. (*E.g. Adding a small amount of a non-edible substance to a batch of cookie dough ruins the entire batch. If the batch were being packaged in a factory along with cookies from other batches, all packages could potentially be contaminated.)* Explain	Listen and discuss: - what are the impacts of recycling contamination? - what can we do to solve this problem?	This introduction sets the tone for the rest of the lessons by challenging students to reduce the limitations of our technology (MS-ETS1-1). It also introduces the concept of scale (MS-ESS1- 3) which can be emphasized with mathematical examples in the Elaborate portion of the lesson. To fully engage students in rigorous content**,** use the challenge information to foster honest discussion and curiosity about an effective solution. Keep the focus on improvement rather than the obstacles! Consider a field trip to a recycling processing center prior to or just following this lesson in order to provide a greater understanding of scale and the impact of contamination.

that the same is true for paper recycling; non-recyclable materials that are included in paper recycling bins can contaminate an entire truckload of paper and prevent it from being recycled. - discuss impact of the school's accuracy in recycling paper; *How do our actions have a larger impact?*		
Small Groups (10 min) Provide groups with explicit guidance about which items should/should not be placed in classroom recycling bins. (See visual in resource section below) Provide small groups with example trash and recycling bins from actual classrooms (contents may be incorrect!). Guide students through making and recording initial observations of current recycling practices: - *What items do students see in each bin type?* - *What types of items are correctly placed? Incorrectly? Unsure?* - *Why do students think these items were put into these bins?*	Students work in small groups to make and record initial observations of bins and begin to develop initial thoughts and questions regarding the *Recycle Right!* challenge.	Students may have very specific questions about why certain items can or cannot be recycled. Acceptable items vary from location to location based on who and how the waste is processed. Remind students that they will use the guidelines in place for DCPS (or your specific Charter School). Encourage critical thought and discussion about this, but connect students back to thinking about how this information is shared with the school community and the potential for this to be a portion of their solution. You may or may not provide students with gloves for observing trash and recycling bin contents. So long as students have a means of fully observing bin contents without touching items, gloves are not needed.

Whole Class (20 min) Provide opportunity for students to share their first reactions to the challenge: - *What were you the most surprised by?* - *What questions do you have?* Lead brainstorming about improvements that could be made to the classroom recycling process that would result in improved accuracy. Work with the group to select an overall change or solution to be implemented. Examples may include improving signage and/or labeling near bins; an educational campaign for students and/or teachers.	Students share initial reactions to the challenge and preliminary bin observations. Brainstorm changes that could be made to improve recycling accuracy and share ideas.	Students will likely have a large range of ideas for changes/solutions. Guide your group/class as needed based on the time, resources, and constraints in place for your group/class. For example, if multiple classes are engaging in the challenge, a whole-school solution may not make sense; a class will need to focus on a sub-set of classrooms/students so that other portions of the school can serve as the data set for other groups. Encourage students to think about their initial observations and how to address the "incorrect" items; *What change needs to be implemented to prevent similar problems from continuing*? (MS-ESS3-1) *Who is involved in the collection process? Where in the process can improvements or changes be made?* Your custodian(s) can be a great resource – both for information and student engagement. Consider including them (either in person with students or their input shared via you as a teacher) in the solution development and implementation.

Key instructional decisions, evidence, and possible next steps.

Decision	Evidence	Next Steps if "no"
Do students have enough of a basic understanding of the paper recycling process to understand the negative impact of contamination?	Student comments during the Initial discussion of recycling impacts.	Share background information on paper recycling with students (see resource section)

Explore (45+ min)
Daily Objective and Summary: Students will work to plan, implement, and measure the accuracy of the selected recycling solution. The structure for data collection and implementation may vary significantly based on the timing of these lessons and the structure/size of the group you are working with. Some teachers may choose to have whole classes work on planning and implementing the solution. Others may divide the work across smaller groups. The same may be true with data collection, especially since multiple weeks of data will need to be collected over the course of 3 weeks while other content/units will be interspersed between lesson segments.
Teacher will need: projector or other means of collecting and displaying class data and group work
Students will need: student lab packet, access to multiple classrooms (for data collection)

Teacher	Students	Notes
Solution Planning **Whole Class** & **Small Group** (20 min) Review the selected solution to improve recycling accuracy. Provide students with guidance regarding the timeline of data collection (see notes) and any other school/class specific constraints. Guide students in developing more detailed procedures for implementing the solution.	Work in small groups to develop ideas for implementing recycling solution.	Depending on the structure of your school and the group working to implement the solution, you will need to provide more/less guidance and structure for this portion of the lesson.

Data Collection **Whole Class** & **Small Group** (25 min) Review which materials are acceptable in the trash and recycling bins in classrooms. Review the structure of the data table with students. Review which classrooms are serving as the data set and how this serves as a sample for the larger school. Make an explicit connection back to the concept of scale presented in the Engage portion of the lesson. Guide students to visit the selected classrooms for data collection. Facilitate large-group data recording and sharing (as needed based on structure of group).	Visit classrooms to collect and record data. Share data with the larger group.	This portion of the lesson will need to be repeated at least four times throughout the challenge. The first round of data collection should be prior to the implementation of the selected recycling solution and will serve as baseline data. To participate in the challenge, data must be collected from a minimum of 10 classrooms. You should pick which classrooms and how many based on the structure of your group/class(es). Take the opportunity to highlight the sample of classrooms being examined and how this is representative of the school as a whole. (MS-ESS1- 3)
Solution Implementation **Varied Format** (varied duration) Actions will vary based on solution selected.	Actions will vary based on solution selected.	This portion of the lesson is the most variable in structure and duration. It may be conducted almost entirely outside of class (students create posters for homework and teacher coordinates their placement) or class time may be provided.

Key instructional decisions, evidence, and possible next steps.

Decision	Evidence	Next Steps if "no"
Does the group have a potential solution that will address the problem noted during the initial observations?	Students have suggested at least one solution that is feasible for the time, resources, and structure of the group.	Use guiding questions to scaffold student thinking around concrete steps that could be taken at the classroom or school level. For example: *Do you think students know what can be recycled? How could we share this information?*
Is data being accurately collected?	Students can explain their data collection process and data based on the contents of classroom bins. Students may also take photos of sample bins if technology allows.	Review the challenge documentation with students (see resources) and complete a sample data table based on an example bin.

Explain (30 Min)
Daily Objective and Summary: Students will analyze the data they have collected in order to make evidence-based claims regarding the success of their selected solution.
Teacher will need: projector, class data from each round of data collection
Students will need: student lab packet, calculators (optional)

Teacher	Students	Notes
Graphing **Whole Class & Small Group** (15 min) Review project timeline and introduce graphing template. Guide small groups in graphing the recycling accuracy over time: line graph of percentage accuracy (y-axis) vs. time (x-axis) with a vertical line separating baseline data from	Review data table and identify data points to be graphed. Work in small groups to graph the recycling accuracy over time.	Take the opportunity to remind students of the role of baseline data – the data collected prior to the implementation of the solution. Your baseline data will provide a point of comparison from which to measure the success of the solution. Enrichment option: individual-school paper

post-solution implementation data. Circulate to provide support for students/groups needing assistance with graphing.		recycling data is for DCPS schools by request from DGS. Students could use their percentage accuracy data to extrapolate the accuracy in tonnage for their school. See resource section for guidance on calculations.
Claims from Data **Small Group & Whole Group** (15 min) Review process for making claims from data and guide students to making at least three claims based on the data. *What other questions do the data leave unaddressed?* *What were the successful parts of the solution? Which pieces were missing or need to be reworked?* Provide an opportunity for small groups to share their ideas with the whole group. Allow students to add to or edit their evidence-based claims after hearing other students' ideas.	Work in small groups to identify key pieces of data and make at least three claims based on that evidence.	Take the opportunity to highlight what worked and what didn't with students, emphasizing that this isn't an ending point but instead a point for reflection and improvement. This is a critical step in the engineering process. (MS-ETS1-3 & MS-ETS1-4) Remind students that they will need to use these evidence-based statements in their recommendations to their administration in future lessons. It will be important to consider multiple viewpoints of what worked and what didn't.

Key instructional decisions, evidence, and possible next steps.

Decision	Evidence	Next Steps if "no"
Do students have accurate visualizations of the data?	Students graphs	Provide individualized or small group support with graphing as needed.
Are students' claims based on evidence?	Student evidence-based claims in lab packet	Provide individual or small-group support prior to the next lesson

Elaborate (25 Min) **Daily Objective and Summary:** Students will use their evidence-based claims to make recommendations to their school's administration and staff regarding changes to classroom recycling processes. **Teacher will need:** projector **Students will need:** student lab packet and writing materials ***Optional:*** *Teacher may choose to engage school leadership or the DCPS Recycles! Team to provide a real-world audience for student work.*		
Teacher	**Students**	**Notes**
Letter Writing Intro **Whole Group** (5 min) Review connection between this project and the challenge posed by Sustainable DC. Review general letter structure.	View exemplar letter and template.	Provide students with example of letter and the template/scaffold. Remind students that all claims must be supported by evidence (MS-ESS3-4) and that their suggestion may include a modified solution or combination of ideas (MS-ETS1-4) While this plan is designed around a letter-writing student work product, the format of the evidence-based claims could easily and effectively be differentiated. For example, students could produce a digital piece that contains written work.
Letter Writing **Individual or Small Group** (20 min) Guide students in writing their individual letters to the administration. Circulate to provide support to individual students or small groups as needed.	Students compose their letters using their student lab packets, exemplar, and template as supporting documents.	

Key instructional decisions, evidence, and possible next steps.

Decision	Evidence	Next Steps if "no"
Are students using their evidenced-based claims as the focus of their suggestions?	Presence of evidence-based claims in letters.	Targeted feedback for where to include the statements based on the template.

Evaluate (50 Min)
Daily Objective and Summary: Students will review a peer's draft letter, provide and receive feedback, and finalize their letters to the administration. Students will then work in pairs to develop and practice making an oral argument based on their letter in preparation for a conversation with an administrator, staff member, or DGS representative.
Teacher will need: projector
Students will need: student lab packet, draft letter, letter rubric

Teacher	Students	Notes
Letter Review & Feedback **Whole Group & Pairs** (10 min) Review the letter rubric with the group and facilitate students moving into pairs to review each other's work. Circulate to ensure that students are providing feedback based on the rubric.	Students use the rubric to review a partner's work and provide feedback.	Providing a real-world audience for students will significantly increase engagement and the effectiveness of a long-term solution within your school. DGS' DCPS Recycles! Team are prepared to serve as an audience for your students – reach out to them!
Letter Revision **Individual** (10 min) Circulate to ensure that students are incorporating the feedback into their finalized letters.	Students use the feedback to revise their own letters.	

Conversation Prep **Partners** (10 min) Guide students into using the template to prepare for an oral conversation with a staff member or administrator. Model an example of the conversation using the exemplar letter.	Students use their suggestions and key pieces of evidence to develop an oral presentation of their suggestions.	Remind students that while a conversation may be less structured than the letter, it is still critical to use evidence-based claims to support their recommendations.

Key instructional decisions, evidence, and possible next steps.

Decision	Evidence	Next Steps if "no"
Are students incorporating their claims from evidence in their conversations?	Conversation templates	Provide explicit connection for students using the two sections in the lab packet.

Key Resources:

Sustainable DC: http://www.sustainabledc.org

DCPS Recycles Right! Competition information - https://docs.google.com/spreadsheets/d/101fd2IfvZZjDIvV1FsC387L-IuOdLUBUhSbJlhnK9qk/edit#gid=103589437&vpid=A1

DCPS Classroom Recycling Acceptable Items: http://dgs.dc.gov/node/1106332

Volume to weight conversion: https://www.kab.org/recycle-bowl/recycling-resources