

Zero Waste Heroes

Educator Guide

a curated collection of K-12 activities
to explore ways of reducing waste
from the Environmental Education Alliance of Georgia



Zero Heroes Teacher Guide

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Introduction

The intent of the Zero Heroes lesson collection is to provide opportunities for students to explore the goal of generating “zero waste” from the perspective of various environmental impacts, and to investigate solutions on individual, school-wide and societal levels.

The Zero Heroes lesson collection can be used several ways. Students can investigate an aspect of waste reduction and materials management with lessons that cover a science standard at their grade level. Or all of the lessons can be adapted and taught together in an Environmental Science or Sustainability course.

Zero Heroes goes beyond the “3 Rs” (recycle, reduce, reuse) to consider ways of preventing waste (rethink, reject, refuse) and for dealing with waste (rot, repair, repurpose, recover) through the lens of sustainable living. Students who complete the entire set of lessons will examine systemic problems from fast fashion to food production; assess the roles of individuals, corporations, and societies in contributing to the root causes of excess waste; explore the lifecycles of materials and consumer products, manufacturing, marketing, and packaging; evaluate environmental impacts of waste disposal including disproportionately affected communities; reduce toxicity of waste materials; consider perspectives and needs of various stakeholders; compare recycling to a circular economy; identify ways of bringing attention to the need for change; determine the highest impact ways that students can make a difference in the world; and conserve the planet’s natural resources.

Acknowledgments

The Zero Heroes lesson collection was created by Environmental Education Alliance (EEA) the backbone organization for environmental education and outdoor learning in Georgia. EEA envisions a world where every child grows up to be a problem-solver who is connected to nature, knowledgeable about the environment, and empowered to create a more just and sustainable future.

This collection was curated and created with support from Environmental Education North Carolina and their grant from Environmental Protection Agency Region 4. Zero Waste Heroes is a Georgia companion piece to the ‘Don’t Waste It’ project. We are grateful to Lauren Pyle, Executive Director of EENC, for making this project possible.

Standards-alignment

Zero Heroes lessons are compatible with the Georgia Standards of Excellence in Science. The lessons will be useful in states that have adopted Next Generation Science Standards or embraced the Framework for K-12 Science Education and its research-informed “three-dimensional learning”. Each lesson provides a phenomenon-based approach which begins with a real-world event that students observe and explore before reading or receiving any information that explains it. Prompted by the question “What do you notice?” students advance a tentative explanation for what they have observed. Then, in response to the question “What do you wonder?” they ask questions that will form the basis for student-directed research. After the research phase, teachers engage students in learning experiences that present new information and insights. Each lesson ends with a chance for students to refine and revise their original explanations to incorporate what they have learned. The essence of “three-dimensional science” is for students to explore before core ideas are explained. For that reason, vocabulary is not memorized in advance, but learned “just in time” – when there is a context and need to understand new words. Standards are listed for each lesson.



Instructional Strategies

Each lesson features one or more of the following three types of learning activities:

Eco-Engineering Challenges

The Eco-Engineering Challenges were created by the Environmental Education Alliance (EEA) to engage students in making sense of phenomena and solving problems using design thinking. Each challenge is a STEM learning activity that integrates science, technology, engineering, and math, and contains the following elements:

- an unexplained phenomenon that students observe, ask questions about, and try to explain
- an authentic environmental problem to solve
- a curated collection of research (articles, infographics or other information)
- a design challenge that engages students in making something to help solve the problem (a prototype)
- an opportunity to test and refine the prototype and present it to an audience

To learn more about eco-engineering challenges, consider watching [this slide presentation](#). The teacher activities in the presentation can be explored together by a professional learning cohort.

Community Science Projects

Community Science projects – also called Citizen or Participatory Science - involve students in crowd-sourcing data needed by scientists for authentic ongoing research projects. The data collected may also be useful to students as evidence for their claims about waste-related problems.

Many students report increased self-efficacy and confidence when working on community science projects because they are contributing to something larger than themselves by doing real science that is needed and valued by others. In addition to collecting data and uploading it, some participatory science projects require students to analyze the data, look for trends, construct explanations, or recommend actions. Examples of community science projects include Litterati (students geotag and analyze sources of trash they collect from the ground) and Soil Your Undies (students bury cotton underwear, dig it up 30 days later, and report the extent to which the fabric has biodegraded).

Environmental Stewardship

Several Zero Heroes lessons invite students to design and implement solutions to bite-sized problems in the school or schoolyard. This entails a process of defining and researching a problem; brainstorming solutions; pitching ideas complete with an “elevator speech”, budget estimate, and timeline; deciding collectively on a class project; implementing it; presenting the project to an authentic audience; assessing its impact; and reflecting on its value to students.

Offering opportunities for environmental stewardship is important because students often report feeling discouraged and disengaged when learning about environmental problems. Real world problem-solving contributes to feelings of self-determination and inspires civic action.

Field Investigations

Most of the investigations in this lesson collection will take place in the schoolyard. However, some engage students in school-wide observations and data collection, both inside and outside the building. The purposes of the investigations are to identify current practices and procedures, to assess the impacts of those practices, and to better understand a waste-related problem and its potential solutions.



Inclusive Teaching Practices

Teaching about zero waste can incorporate student experiences, cultures, and perspectives by:

- recognizing that each student's culture and experiences result in valuable contributions to class discussions and brainstorming sessions: the greater variety of ideas, the better the brainstorming results
- featuring scientists, inventors, policy makers, and leaders of diverse ages, genders, abilities, races and ethnicities, so every student can imagine themselves in those roles
- analyzing data with tools such as [EJ Screen](#) and the [EE Landscape Analysis](#) dashboard to identify patterns and connections between where waste is found (locations of landfills, coal ash pits, Superfund sites) and health impacts on nearby communities (<https://www.eealliance.org/ee-landscape-analysis.html>)
- using curated collections of research articles with the [jigsaw protocol](#), which brings together readers of different abilities in "expert" groups where they analyze the same article, before returning to their "home groups" where each student presents information about a different article. Note: this approach is ideal with the same number of groups as the number of students per group (and number of articles).

Lesson Format for Zero Heroes

Most lessons in the Zero Heroes Teacher Guide are structured in the following way:

Standards The sections of a standard that are addressed by the lesson are highlighted in yellow.

Preparation Obtain materials listed for each lesson and complete advance preparations as noted.

Directions for each lesson or design challenge (on following page) are written for the teacher. Provide students with the appropriate Lab Report from the appendix.

Phenomenon: Present the phenomenon without explanation before or after students observe it (typically: sound off).

What Do you Notice? Engage students in writing about what they observed (or making a labeled drawing) that tells what, who, why and how. This will serve as a tentative explanation, while they are making sense of the phenomenon.

What Do you Wonder? Engage students in asking their own questions, which will form the basis for their research.

Student Research After students ask their questions, consider placing each question on a sticky note, grouping questions in categories, and grouping students to do research according to their interests. Curated collections of articles are intended to be read and shared using the [jigsaw protocol](#): www.jigsaw.org/ [NewsELA](#) is a good source for additional articles, which are available at multiple reading levels. [Science Journal for Kids](#) and [Science News for Students](#) are vetted sources of articles that can be reviewed and selected in advance for students. More articles are provided than needed.

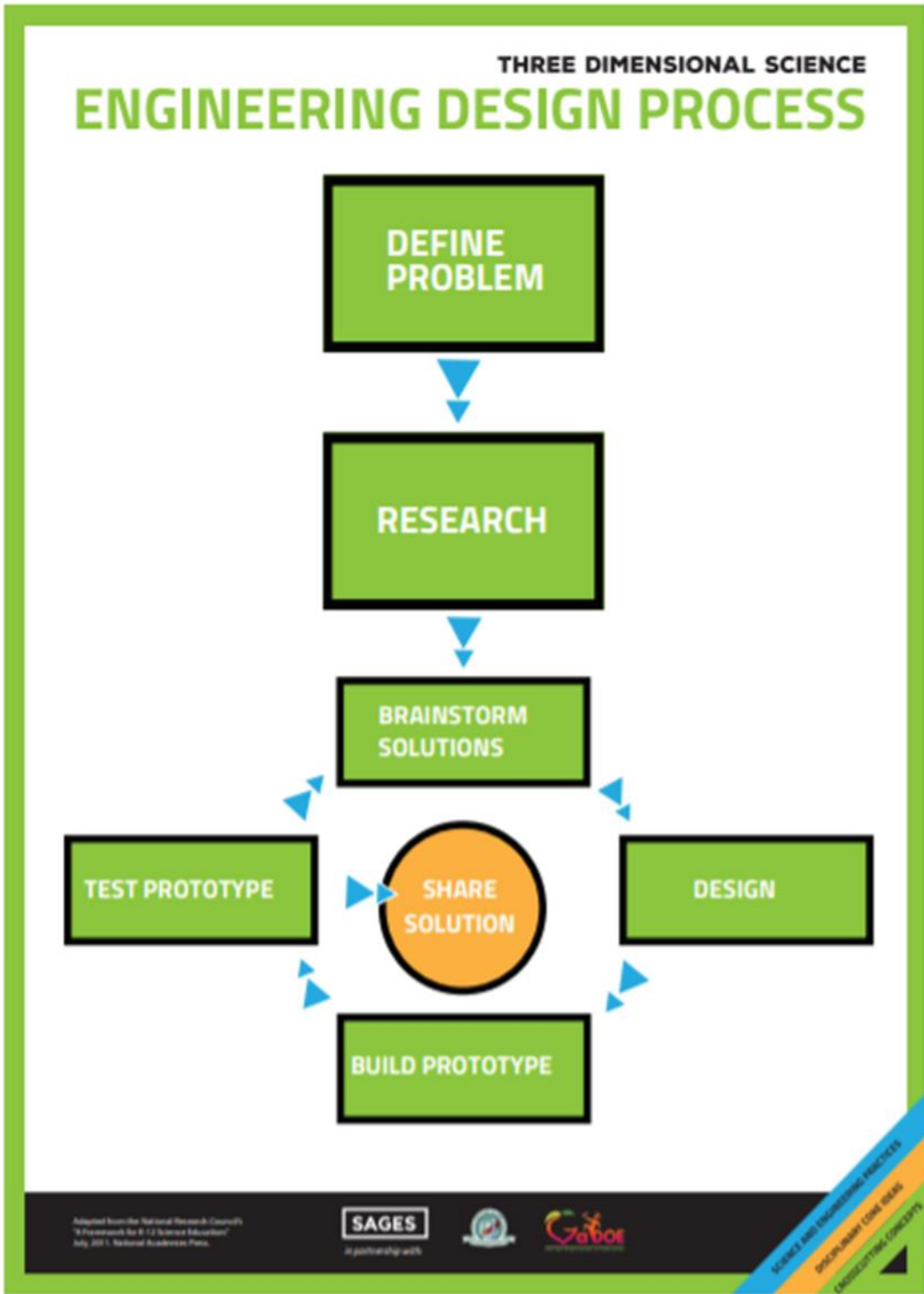
Teacher-Directed Activity Introduce new knowledge by showing an explainer video or substituting another activity.

Zero Heroes Lesson Activity This lesson provides an Eco-Engineering Challenge, an Environmental Stewardship Project, a Community Science Project, or Field Investigation. The [Environmental Education Alliance](#) offers professional learning courses, workshops, and certification to increase teacher capacity for engaging students in these ways.

Revised Explanation Allow students to return to and revise their initial explanations of the phenomenon (the What Do You Notice? section). Clear up any student misconceptions about the science standard and how its core idea relates to waste prevention or reduction. A good source of background information - including a video 'crash course' on each standard - can be found at the [Wonder of Science](#) (or [Bozeman Science](#)) web sites. Note that Georgia standards are not identical to NGSS standards, but both share a "three dimensional" phenomenon-based approach to science education.

Teacher Resources Articles and activities that can be used for Teacher-directed Activities will be found in this section





Credit: Captain Planet Foundation