Madison Public Schools

Environmental Science - Unit 3 - Innovation and Promise

Unit Focus

Students will be exploring the innovative ways people are developing to help humanity achieve a sustainable relationship with the natural environment. Students will engage with many emerging products and practices that are working to mitigate the negative consequences of modern society on the environment. This final unit is largely research-based and requires students to learn about a new technology that aims to resolve an environmental issue and develop their own version that can be implemented here in Connecticut. Students will need to apply their understanding of environmental science to demonstrate how this new technology improves environmental quality. They will then work to persuade a panel of judges to invest in this new product or process, while accurately explaining the science that governs its efficacy and justify the need for the technology by discussing the consequences of inaction.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science

High School Earth and Space Sciences: 9 - 12

- Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. *HS-ESS3-4*

Next Generation Science Standards (DCI)

Science: 11

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. *ESS3.9.C1*
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. *ESS3.9.C2*
- Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. *ESS3.9.D1*
- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. *ETS1.9.A1*
- Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. *ETS1.9.A2*
- When evaluating solutions it is important to take into account a range of

Transfer

T1 Make observations and ask questions to define a problem based on prior knowledge and curiosity that stimulates further exploration, analysis, and discovery.
T2 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.

Meaning

Understanding(s)	Essential Question(s)
U1 People are continuously working to develop creative methods to solve many of the environmental crises that are impacting the health of our environment. **U2** Design solutions must take into account functionality, competing interests, stakeholders, constraints, and viability of the design. **U3** Citizen scientists are take personal responsibility and action in their local communities, understand the scientific principles that govern environmental well-being, and work to improve the environment and inform others of the consequences of intended and unintended actions on the environment. **U4** Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.	**Q1** How can we design solutions that improve environmental quality while addressing competing interests? **Q2** How can I transform a design to make it useful in a different situation? **Q3** How can I clearly articulate, justify and garner support for my ideas?

Stage 1: Desired Results - Key Understandings

constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. *ETS1.9.B1*

NGSS/NSTA Science & Engineering Practices

NGSS Science & Engineering Practices: 9-12

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information. *SE.9-12.1.1*
- Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations. *SE.9-12.1.8*
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. *SE.9-12.6.2*
- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects *SE.9-12.6.3*
- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. *SE.9-12.6.4*
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. *SE.9-12.6.5*

Student Growth and Development 21st Century Capacities Matrix

Creative Thinking

- Innovation: Students will be able to take an existing solution or object in order to consider limitations and possible transformations. *MM.2.1*

Collaboration/Communication

- Presentation: Students will be able to relay information and ideas to an authentic audience (other than the teacher) to promote collective understanding. *MM.3.3*

Global Thinking

- Citizenship: Students will be able to identify and contribute to critical issues in society in an ethical and responsible manner. *MM.5.3*

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 Environmental issues are occurring in the Town of Madison. **K2** Human actions alter natural processes. **K3** Environmental science principles should be utilized when generating ideas regarding issues and solutions to problems. **K4** Innovative ideas such as "green" architecture, farming, and landscaping, are some of the ways that human ingenuity is already making a positive impact on the health of our environment.	**S1** Research and analyze current innovative designs that are being developed and implemented in order to solve environmental concerns. **S2** Transform existing solutions meant to improve environmental quality and apply them to our local community. **S3** Effectively communicate and persuade a group using scientific principles to justify your position.