Madison Public Schools

Marine Science and Technology - Unit 4 - Independent Project: Final Presentation

Unit Focus

The purpose of the Marine Science and Technology Independent Project is to explore marine-related issues through an approved project of their own design. This will help students become more independent, develop perseverance, and become better critical and creative thinkers to help them plan their futures. The entire course examines the chemical, biological and geological properties of the sound as well as marine-related careers from boat building to aquaculture. Boat construction, fishing rod building, maintenance of organisms, physical, chemical, and ecosystem studies related to oceanography are part of this "hands-on" course. Select field trips support the curriculum and provide experiences that students can apply to their individual projects as well as provide practical school to career experience.

Stage 1: Desired Results - Key Understandings

Standard(s)

ITEEA - Standards for Technological Literacy
Technological Literacy: K-12

- Students will develop an understanding of the role of society in the development and use of technology. *6*
- Students will develop an understanding of the attributes of design. *8*
- Students will develop an understanding of engineering design. *9*
- Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. *10*
- Students will develop the abilities to apply the design process. *11*
- Students will develop the abilities to assess the impact of products and systems. *13*

NGSS/NSTA Science & Engineering Practices
NGSS Science & Engineering Practices: 9-12

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible variables or effects and evaluate the confounding investigation's design to ensure variables are controlled. *SE.9-12.3.1*
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g.,

Transfer

T1 Develop a product/solution that adheres to key parameters (e.g., cost, timeline, restrictions, available resources and audience).
T2 Use the scientific process to generate evidence that addresses the original questions.
T3 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.
T4 Communicate effectively based on purpose, task, and audience to promote collective understanding and/or recommend actions.

Meaning

Understanding(s)	Essential Question(s)
U1 When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. **U2** Complicated problems may need to be broken down into simpler components in order to develop and test solutions. **U3** Citizen scientists play a crucial role in environmental activism and conservation.	**Q1** How can I contribute to society? **Q2** How can the various proposed design solutions be compared and improved? **Q3** How does your final project address your problem through engineering? **Q4** How do I create a design that will perform as intended and falls within the necessary constraints?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 Steps to improve and/or protect the environment, no matter how small, can contribute to the health and	**S1** Conduct scientific research using an engineered solution to address a problem.

Stage 1: Desired Results - Key Understandings

number of trials, cost, risk, time), and refine the design accordingly. *SE.9-12.3.2* • Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts. *SE.9-12.3.3* • Select appropriate tools to collect, record, analyze, and evaluate data. *SE.9-12.3.4* • Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables. *SE.9-12.3.6* • Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. *SE.9-12.4.1* • Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data. *SE.9-12.4.3* • Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success. *SE.9-12.4.6* **Student Growth and Development 21st Century Capacities Matrix** *Critical Thinking* • Synthesizing: Students will be able to thoughtfully combine information/data/evidence, concepts, texts, and disciplines to draw conclusions, create solutions, and/or verify generalizations for a given purpose. *MM.1.3* *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*	well-being of ecosystems. **K2** Technology is any modification of the natural world made to fulfill human needs or desires **K3** The fields of science and engineering are mutually supportive. **K4** Engineering is a systematic and often iterative approach to designing objects, processes, and systems to meet human needs and wants **K5** The engineering design process begins with the identification of a problem to solve and the specification of clear goals, or criteria, that the final product or system must meet. **K6** An application of science is any use of scientific knowledge for a specific purpose, whether to do more science; to design a product, process, or medical treatment; to develop a new technology; or to predict or mitigate the impacts of human actions.	**S2** Gather and analyze data and draw and communicate conclusions based on the data. **S3** Apply scientific reasoning to interpret data that supports the independent project conclusion **S4** Persevering and completing a long term project.