Unit 05: How does this work (CTE)

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **FY**
Status: **Published**

Standards Alignment

New Jersey Student Learning Standards

Practice 1. Asking questions (for science) and defining problems (for engineering)
Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

Ask questions to clarify and refine a model, an explanation, or an engineering problem.

CCSS.Math.Practice.MP5	Use appropriate tools strategically.
AAAA.K-12.1	Inquire, think critically, and gain knowledge.
AAAA.K-12.1.1	Skills
AAAA.K-12.1.1.1	Follow an inquiry-based process in seeking knowledge in curricular subjects, and make the real-world connection for using this process in own life.
AAAA.K-12.1.1.2	Use prior and background knowledge as context for new learning.
AAAA.K-12.1.2	Dispositions in Action
AAAA.K-12.1.2.3	Demonstrate creativity by using multiple resources and formats.

Integration of Career Readiness, Life Literacies and Key Skills

12.9.3.ST	Science, technology, engineering & mathematics
12.9.3.ST.3	Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
12.9.3.ST-ET	Engineering & Technology Career Pathway
12.9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
12.9.3.ST-ET.2	Display and communicate STEM information.
12.9.3.ST-ET.3	Apply processes and concepts for the use of technological tools in STEM.
12.9.3.ST-ET.4	Apply the elements of the design process.
12.9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
12.9.3.ST-SM	Science & Mathematics Career Pathway
12.9.3.ST-SM.2	Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.

CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technology / Integration of Computer Science and Design Thinking

TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.12.C.6	Research an existing product, reverse engineer and redesign it to improve form and function.
TECH.8.2.12.D	Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.
TECH.8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math Section

LA.K-12.NJSLSA.W	Writing
LA.K-12.NJSLSA.W7	Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
LA.W.9-10.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale
Unit Rationale The purpose of this unit… **The purpose for teaching reverse engineering is it provides students with insight on how different mechanical, electrical, and structural subsystems work together. Using various forms of written and visual communication, design teams will be challenged to capture the process in a manner that will allow others to reassemble the product without any verbal communication.**

Meaning

Essential Questions

Essential Questions

- **How do products function?**
- **What is the role of dependability and reliability in product design?**
- **What is the role of reverse engineering in research and development?**
- **What is the connection between reverse engineering, reassembly, and budgeting?**
- **Who should reverse engineer products?**

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

- **Products function because of a series of subsystems working together.**
- **Troubleshooting can require reverse engineering.**
- **A decision as to whether a product must be re-assembled must be made prior to beginning the reverse engineering process.**
- **The failure of one subsystem may result in malfunction.**
- **All stakeholders have a vested interest in the long term durability and reliability of products.**

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- **The role of reverse engineering and its process.**
- **How products function.**
- **Why subsystems are important and how they function.**
- **How reverse engineering and reassembly are connected.**
- **How research and development play apart in reverse engineering and the design process.**

Skills

Skills

Student will be skilled at …

- **Recognize that products in the designed world function as a result of multiple subsystems working together.**
- **Recognize the challenges of design under constraint.**
- **Identify how different products work.**
- **Differentiate between the various sub systems; their functions and their components.**
- **Demonstrate the mechanical aptitude to complete the reverse engineering process without damaging the product and its subsystems.**
- **Document the proper sequence of the reverse engineering process through text and images.**
- **Demonstrate the ability to reconstruct a different product using only text and images without any verbal interaction.**
- **Demonstrate effective use of hand tools.**
- **Present evidence of working product to class and instructor upon completion.**
- **Discuss multiple ways to assess product design in order to facilitate disassembly and reassembly.**

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

- **Tools:** hand tools
- **Materials:** Disposable cameras, toys, electric toothbrush

Formative Assessment Strategies

Formative Assessment Strategies

- **Exit ticket.**
- **Engineering notebooks.**
- **Notebook checks.**
- **Design sketches.**
- **Twitter board.**
- **Teacher lead questions and discussion.**
- **Morph chart.**
- **Peer feedback.**
- **What is technology worksheet.**
- **Scale model.**
- **What did we learn chart.**
- **KWL chart.**
- **Daily Design Logs.**
- **Feedback meetings with teacher.**
- **Self rating on cleanup/organization.**
- **Presentation practice.**
- **Thumbs up/down/sideways.**

Learning Activities/Unit of Study

Learning Activities/Unit of Study

- **Do Now- take out materials from the previous day, log on to computers and open up documents, small activity to recap the day before.**
- **Review - recap on material that has been covered (questions, discussion, whiteboard)**
- **Lecture on simple machines and mechanical advantage.**

- **Demos- the teacher will demo how simple machines work with materials around the classroom**
- **Students will work in teams to complete a design project.**
- **Students will review mechanical advantage through practice problems and apply it to their design project.**
- **Thumbs up/down/sideways - quick formative assessment to gauge students level of understanding.**
- **Student presentations- students will present their ideas to the class to receive feedback from their classmates.**
- **Feedback meetings- students will meet with teacher at the conclusion of each step in order to get the teachers approval before moving forward.**
- **Open lab days- students will work on design projects or assignments(students/teams may be at different steps of the project).**
- **Testing and evaluation- students along with the teacher will test student projects and evaluate the projects success.**

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, GIfted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many

teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.