

Unit 04: Can I borrow a pencil? (CTE)

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

Standards Alignment

New Jersey Student Learning Standards

CCSS.Math.Practice.MP5 Use appropriate tools strategically.

Integration of Career Readiness, Life Literacies and Key Skills

12.9.3.ST	Science, technology, engineering & mathematics
12.9.3.ST-ET	Engineering & Technology Career Pathway
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-ET.6	Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.
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.
12.9.3.ST-SM.4	Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
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.B	Technology and Society: Knowledge and understanding of human, cultural and society values are fundamental when designing technology systems and products in the global society.
TECH.8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
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.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.

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

LA.K-12.NJLSA.W	Writing
LA.K-12.NJLSA.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 of teaching this unit is to expand on the application of the design process. Students will be taught simple machines, the application of mechanical advantage, and structural failure.

Meaning

Essential Questions

Essential Questions

- How has mechanical advantage impacted the designed world?
- When is the proper time to design a system output for speed and torque?
- How are mechanical and structural engineering related?
- How can using the same materials for two different prototypes garner different results?
- How does a design team member work effectively to be a productive person of the team?

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

- The application of mechanical advantage to different systems is essential to a highly functioning designed world.
- Speed and torque are inversely related to one another.
- Materials that cannot be glued together present unique challenges.
- Structural failure can compromise mechanical function.
- Proper classroom organization facilitates efficient time management.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know...

- How gears work.
 - How torque and speed is applied to gears.
 - How they are beneficial to a design.
- How mechanical advantage is applied and calculated.
- How the six simple machines work and are applied relating to mechanical advantage.
 - Wheel/axle, lever, inclined plane, wedge, pulley, screw.
- The relation between mechanical and structural engineering.
- Various materials can undergo different amounts of stress.

Skills

Skills

Student will be skilled at ...

- Research the history and application of modeling systems.
- Recognize the challenges of design under constraint.
- Communicate evidence of the design principles and necessary content in portfolio development.
- Identify the various types and functions of gear systems.
- Differentiate between systems designed for speed and torque.
- Demonstrate the ability to calculate mechanical advantage.
- Demonstrate the ability to construct structurally sound prototypes.
- Demonstrate effective use a voltmeter and power supply effectively.
- Demonstrate how to achieve different results using the same materials.
- Execute structured learning experiences to maximize efficient use of time and material.
- Present evidence of project detail to classmates and instructor.

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

- **Tools:** sandpaper, hand tools, hot glue guns, scroll saw, drill, sander(s)
- **Materials:** Low voltage DC motors, variety of gears, power source, voltmeter
- **Teacher Resources:**
 - <http://curriculum.vexrobotics.com/curriculum/mechanical-power-transmission/gear-ratios>
 - <http://www.mstworkbooks.co.za/technology/gr8/gr8-technology-12.html>

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--Review** questions, 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-** teacher will show student new skills by going through them step by step(illustrator skills, machine demos, brainstorming techniques, tutorials)
- **Partners/teams** - students will work in teams for projects, receive feedback, and complete other

assignments

- Board/White Board Work - (solve problems/practice skills at board, or at seat with individual white boards).
- Review and practice skills using a variety of materials - (machines, programs, brainstorming techniques, work through design challenges/projects)
- Student led instruction
- Thumbs up/down/sideways - quick formative assessment to gauge students level of understanding
- Jeopardy style review games.
- Students “as teachers” where they present a design ideas they have brainstormed and researched
- Feedback- meet with teacher to receive feedback on each part of the assignment before moving forward.
- 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

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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.