Unit 07: Inventions and Innovations

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.

Practice 2. Developing and using models
Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

Design a test of a model to ascertain its reliability.

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-12.1.2	Dispositions in Action
AAAA.K-12.1.2.3	Demonstrate creativity by using multiple resources and formats.
AAAA.K-12.1.3	Responsibilities
AAAA.K-12.1.3.1	Respect copyright/intellectual property rights of creators and producers.
AAAA.K-12.2	Draw conclusions, make informed decisions, apply knowledge to new situations, and create new knowledge.
AAAA.K-12.2.1	Skills
AAAA.K-12.2.1.5	Collaborate with others to exchange ideas, develop new understandings, make decisions, and solve problems.
AAAA.K-12.2.3	Responsibilities
AAAA.K-12.2.3.1	Connect understanding to the real world.
AAAA.K-12.3	Share knowledge and participate ethically and productively as members of our democratic society.
AAAA.K-12.3.1	Skills
AAAA.K-12.3.1.1	Conclude an inquiry-based research process by sharing new understandings and reflecting on the learning.
AAAA.K-12.3.1.4	Use technology and other information tools to organize and display knowledge and understanding in ways that others can view, use, and assess.

Integration of Career Readiness, Life Literacies and Key Skills

12.9.3.ST	Science, technology, engineering & mathematics
12.9.3.ST.1	Apply engineering skills in a project that requires project management, process control and quality assurance.
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.
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.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online

	community.
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.A	The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live.
TECH.8.2.12.A.1	Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation.
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.
TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.

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 of this unit is to have students understand how products have evolved. Students will expand their knowledge of the design process by designing their own invention or innovation.**

Meaning

Essential Questions

Essential Questions

- **How do inventions and innovations differ?**
- **How do we determine the development of a consumer product/system designs through inventions and innovations?**
- **When is it appropriate to use a copyright, patent, or trademark in product/system design?**
- **What are features that will be added into the redesign of a more ergonomic product or system?**
- **In industry how does a designer begin the process of developing a new invention/design?**

Enduring Understanding/Indicators of Understanding

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- **An invention is having a completely new and original idea and how it can work in theory. An innovation is either bringing a new product to the market or by getting an organization to try a new way of working.**
- **Research and Development, Consumer Reviews/Feedback, Current trends in technology**
- **Patents refer to an invention; it is given to an inventor to sell, use, or manufacture the invention for a certain number of years. Copyrights refer to the expression of an idea, such as an artistic work. They are governed by different rules, so it is important to know which is applicable to your works. Trademarks are meant to protect words, phrases and logos used in federally regulated commerce to identify the source of goods and/or services.**
- **Ergonomics is concerned with the way design fits people. Ergonomics is a means of providing an environment that best facilitates employees' performance/Productivity.**

- **A designer would use a design proposal to state what the problem they are solving, materials they will use, costs of materials, and the process it would take to design and create that product.**

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- **The difference between inventions and innovations.**
- **How ergonomics is incorporated in products we use on a daily basis and how it can improve our designs.**
- **The importance documentation is in the design world.**
- **How different designs are protected.**
    - **Patents, copyrights, trademarks**
- **How a product can be invented and innovated for improvement.**
- **How to apply the design process from start to finish.**

Skills

Skills

Student will be skilled at …

- **Identify ergonomic features in a product and apply those features to personal design projects.**
- **Understand the importance of a design proposal and properly write one for design project.**
- **Properly give and receive feedback to peers on design ideas.**
- **Develop a survey that will provide valuable feedback in order to improve designs.**
- **Understand and apply the design process when creating an invention/innovation.**
- **Safely and accurately use the tools to process materials in generating a solution to a problem.**
- **Effectively work as a member of a team to meet a common goal.**
- **Evaluate the effectiveness of a solution to a problem through a testing process.**

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

- **Tools:** sandpaper, hand tools, hot glue guns, scroll saw, drill, dremel, sander(s)
- **CAD/CAM Programs:**
- **Teacher Resources:**
    - http://www.useoftechnology.com/what-is-technology/
    - https://www.ted.com/talks/jane_chen_a_warm_embrace_that_saves_lives?language=en

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.**
- **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

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- **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 inventions/innovations, ergonomics, and patents.**
- **Students will work in teams to complete a design project.**
- **Students will review through discussion and questions.**
- **Student led instruction**
- **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).**
- **Students will work on step by step design tutorials.**
- **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.