EXPLORING TECHNOLOGY: INVENTION AND INNOVATION
GRADE 8

EWING PUBLIC SCHOOLS
2099 Pennington Road
Ewing, NJ 08618

Board Approval Date: TBD
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Michael Nitti
Superintendent

In accordance with The Ewing Public Schools’ Policy 2230, Course Guides, this curriculum has been reviewed and found to be in compliance with all policies and all affirmative action criteria.
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Course Description and Rationale

_Exploring Technology: Invention and Innovation_ prepares students with opportunities to apply the design process in the invention or innovation of a new product, process or system.

In this course, students learn all about invention and innovation. They have opportunities to study the history of inventions and innovations, including their impact on society. They learn about the core concepts of technology and about the various approaches to solving problems, including engineering design and experimentation. Students apply their creativity in the invention and innovation of new products, processes or systems.

Finally, students learn about how various inventions and innovations impact their lives. Students participate in engineering-design activities to understand how criteria, constraints and processes affect designs. Students will be engaged in all four of the engineering practices required by the Next Generation Science Standards and the course addresses the NJ State Standards in Technology.

Students will be involved in activities and experiences where they learn about brainstorming, visualizing, modeling, constructing, testing, experimenting and refining designs. Students also develop skills in researching for information, communicating design information and reporting results. The STEM technology courses in middle school provide the basis for more focused high school studies in different STEM disciplines.

This course will be a part of the middle school enrichment schedule. Students will be able to elect this offering as one of their enrichment courses during the 6th grade year. This course will meet every other day for one semester.
Unit 1: An Introduction to Invention and Innovation [15 Days]

Why Is This Unit Important?

Inventions and innovations are important factors in our everyday lives. Inventors think of better ways to do things and design products to make life easier. Invention is a creative process where something new is created that has not previously been held by someone else. Innovations are improvements on an old idea. Invention and Innovation impact life in both positive and negative ways.

Enduring Understandings:

- Develop an understanding of the relationships among technologies and the connections between technology and other fields of study.
- Develop an understanding of the role of society in the development and use of technology.
- Understand and apply the design process.
- Develop an understanding of and be able to select and use information and communications technologies.

Essential Questions:

- What is the process of inventing and how can it be used to solve a problem?
- How have inventions and innovations progressed to meet people’s needs and wants?
- How do inventions and innovations generate improvements in human lives?
- What is the difference between invention and innovation?

Acquired Knowledge:

- Distinguish between invention and innovation
- Historical aspects of invention and innovation
- Impact of invention and innovation on life
- Basic steps of the engineering design process
- Understand common systems in technology

Acquired Skills:

- Importance of teamwork
- Working safety
- Selection and use of technological materials and tools in the inventive process
- Problem analysis
- Critical thinking
- Essential vocabulary
- Brainstorming
- Reflection
Major Assessments:

• Formative Assessments:
  o Worksheets
  o Work habits rubrics
  o Teacher observation
  o Engineering journal entries

• Summative Assessments:
  o Performance Assessments:
    ▪ Rubrics
    ▪ Design, construct and test solutions to challenges
    ▪ Use Internet to locate pertinent information
    ▪ Deliver presentations
    ▪ Complete group tasks
    ▪ Use software to organize and present information
    ▪ Work cooperatively to complete activities
  o Written/Digital Assessments:
    ▪ Concept map/graphical organizers
    ▪ Engineering journal
    ▪ Posters/multimedia

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

• Assessment of prior knowledge: pre-test
• Technology activity/worksheets
• KWL charts
• Manipulative/puzzles

In-Class Activities and Laboratory Experiences:

• Compare and contrast/discussion
• Multimedia presentations/video/PowerPoint
• Worksheets/activity sheets
• Model construction
• Internet research
• Engineering journal
• Analyzing and solving engineering problems using design process

Closure and Reflection Activities:

• Journal entries
• Work logs
• Review/summary discussion
• Self-assessment rubrics
• Team/peer evaluations rubrics
Instructional Materials:

- Computers with internet access
- Reference books/guides
- Poster board/specialty paper
- SmartBoard/LED projector/white board
- Classroom supplies (scissors, tape, clips, clamps rulers, markers pencil)
- On-line technical magazines
- Video
- Basic tools: hammer, pliers, needle nose
- Assorted nut, bolts, washers
- Plastic storage containers

Interdisciplinary Connections:

Mathematics Connections may include:
- Collecting and graphing data
- Developing timelines
- Making measurements
- Analyzing formula/data

Science Connections may include:
- Describing differences between science and technology
- Describing how principles of science and technology work together
- Identifying scientific principles associated with mechanical, electrical, fluid, thermal and chemical systems
- Discussing the influences of science on technology and technology on science

Social Science Connections may include:
- The history of various technologies
- Impacts of research and development
- Society's need for new technology

Language Arts Connections may include:
- Reading
- Developing written and oral presentation
- Taking notes and keeping data
- Participating in class discussion
- Developing a portfolio or engineering journal

Technology Connections:

- http://edison.rutgers.edu
- www.engineeringk12.org
- http://www.scienceonlin.org
- www.mathforum.org
- www.howstuffworks.com
- www.reference.com/wiki/automation
Accommodations or Modifications for Special Education, ESL or Gifted Learners:

- Rephrase written directions or verbal directions
- Preferential seating
- Visual presentation
- Extended time
- Mentoring opportunities
- Independent research/exploration of student interest
- Advanced video

NJ 2009 Technology Standards Covered in This Unit:

Standard 8.2 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.

Strand A: The Nature of Technology: Creativity and Innovation/Rationale: Technology systems impact every aspect of the world in which we live.

Strand B: Technology and Society/Rationale: Knowledge and understanding of human, cultural and societal values are fundamental when designing technology systems and products in the global society.

Strand C: Design/Rationale: The design process is a systematic approach to solving problems.

Strand D: Abilities for a Technological World/Rationale: The designed world is the product of a design process that provides the means to convert resources into products and systems.


NGSS Engineering Standards Covered in This Unit:

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool or process such that an optimal design can be achieved.

**CCSS ELA Literacy in Science and Technical Subjects:**

CCSS.ELA-LITERACY.RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts.

CCSS.ELA-LITERACY.RST.6-8.2: Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

CCSS.ELA-LITERACY.RST.6-8.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements or performing technical tasks.

CCSS.ELA-LITERACY.RST.6-8.4: Determine the meaning of symbols, key terms and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to Grades 6-8 texts and topics.

CCSS.ELA-LITERACY.RST.6-8.5: Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

CCSS.ELA-LITERACY.RST.6-8.6: Analyze the author's purpose in providing an explanation, describing a procedure or discussing an experiment in a text.

CCSS.ELA-LITERACY.RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph or table).

CCSS.ELA-LITERACY.RST.6-8.8: Distinguish among facts, reasoned judgment based on research findings and speculation in a text.

CCSS.ELA-LITERACY.RST.6-8.9: Compare and contrast the information gained from experiments, simulations, video or multimedia sources with that gained from reading a text on the same topic.

CCSS.ELA-LITERACY.RST.6-8.10: By the end of Grade 8, read and comprehend science/technical texts in the Grades 6-8 text complexity band independently and proficiently.

Grade 6-8:  [http://www.corestandards.org/ELA-Literacy/RST/6-8/](http://www.corestandards.org/ELA-Literacy/RST/6-8/)
Unit 2: Invention and Innovation [30 Days]

Why Is This Unit Important?

Learning the process of inventing develops students’ problem-solving abilities and creativity in the broadest sense. Invention provides a unique opportunity for learners to synthesize and apply knowledge and skills in an interdisciplinary, real-life manner. Learning in this unit will focus on the understanding and applying an engineering design process.

Enduring Understandings:

- Invention and Innovation are creative ways of turning ideas into real things.
- To understand and apply the design process to solve problems.
- Inventions and innovations are developed to satisfy a need or want.

Essential Questions:

- What is the process of inventing and how can it be used to solve a problem?
- How do inventions and innovations generate improvements in human lives?
- What is the difference between invention and innovation?
- What does it take to become an inventor?
- What are patents?
- Why are inventor notebooks important?
- How are design requirements involved in the identification of the criteria and constraints of products or systems and how do they affect the final design and development?

Acquired Knowledge:

- Distinguish between invention and innovation
- Historical aspects of invention and innovation
- Impact of invention and innovation on life
- Basic steps of the engineering design process
- Understanding of common systems in technology

Acquired Skills:

- Selection and use of technological materials and tools in the inventive process
- Problem analysis
- Critical thinking
- Essential vocabulary
- Brainstorming
- Reflection

Major Assessments:

- Formative Assessments:
  - Worksheets
  - Work habits rubrics
Teacher observation
• Engineering journal/inventor's notebook entries

• Summative Assessments:
  • Performance Assessments:
    ▫ Rubrics
    ▫ Design, construct and test solutions to challenges
    ▫ Use Internet to locate pertinent information
    ▫ Deliver presentations
    ▫ Complete group tasks
    ▫ Use software to organize and present information
    ▫ Work cooperatively to complete activities
  • Written/Digital Assessments:
    ▫ Concept map/graphical organizers
    ▫ Engineering journal
    ▫ Posters/multimedia

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

• Assessment of prior knowledge: Pre test
• Technology Activity/ Worksheets
• KWL charts
• Manipulative/puzzles
• Video clips

In-Class Activities and Laboratory Experiences:

• Compare and contrast/discussion
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• Model construction
• Internet research
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• Analyzing and solving engineering problems using design process

Closure and Reflection Activities:

• Journal entries
• Work logs
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• Self-assessment rubrics
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Instructional Materials:

• Computers with internet access
• Reference books/guides
• Poster board/specialty paper
• SmartBoard/LED projector/White board
- Classroom supplies (scissors, tape, clips, clamps, rulers, markers, pencil)
- Online technical magazines
- Video
- Basic tools: hammer, pliers, needle nose, scissors, exacto, screwdrivers
- Assorted construction materials related to challenges
- Plastic storage containers

**Interdisciplinary Connections:**

**Mathematics Connections may include:**
- Collecting and graphing data
- Developing timelines
- Making measurements
- Analyzing formula/data

**Science Connections may include:**
- Describing differences between science and technology
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- [http://elecstronics.howstuffworks.com/robots.htm](http://elecstronics.howstuffworks.com/robots.htm)
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