North Carolina CTE

Technology Design and Innovation (2012): Grades 6, 7, 8

Adopted 2012

Exploring Technology/Technology Design and Innovation

1. **Meet Technology**
    1. Technology to the Rescue!
        - Identify why humans develop technology to meet individual needs and wants.
        - Examine how products are improved and invented based on current needs to solve problems that could not be solved without new and improved technology.
        - Develop presentations to demonstrate how technology has been modified to meet the demands of society, industry and/or individuals.
        - Analyze and explain how science, mathematics, and history ensure that technology is developed with more precision and accuracy in meeting the needs of individuals.
        - Recognize how current technologies are often a result of improvements made over time based on current needs and wants using a methodical process studying the historical developments of the specific technology and other similar technology.
        - Utilize creativity to develop technology to meet a need or want in order to have a better understanding of its need in the design of technology.
    2. System
        - Identify how technologies are interdependent.
        - Explain the four essential elements of a four part, closed loop system.
        - Examine how each part of a closed loop system is necessary to ensure that the technology performs its desired goal and/or function.
        - Analyze how different technologies depend on similar and different sets of processes.
        - Demonstrate and explain how the quality of technology is often a result of the integrity of the system and the resources used in the process.

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3. Transforming Resources: From Production to You

    Explain how all technologies depend on manufacturing technologies.

    Analyze how manufacturing technologies use a system design of production to produce goods, which may involve more than one process.

    Identify the difference between durable and non-durable goods.

    Examine how technology that uses a combination of both synthetics and natural resources helps preserve the environment.

    Analyze the similarities between teaming and developing and using technology ethically.

    Develop an assistive medical device using several manufacturing processes.

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2. **Practicing Design**

    1. The Art of Problem Solving

        Examine how technology is developed to solve problems as a result of demands, values, and interests of consumers and businesses.

        Identify how various technology such as medical technologies, agricultural/biotechnology, and communication technology may be developed with economic concerns considered more than environmental and/or long-term impacts.

        Analyze how technology can be both desirable and undesirable based on how it is used by society.

        Find solutions through use of experimentation to solve technological problems which has often been an essential useful strategy in scientific research.

    2. Design: It's a Process

        Examine how the steps involved in engineering design that is responsible for technology often can be performed in different sequences and repeated as needed while some steps must serve as prerequisites to others.

        Identify design as a planning process that utilizes a process necessary to produce creative solutions to problems (steps…)

        Demonstrate the importance of incorporating engineering design within requirements given via criteria (needs) & constraints (limitations).

        Analyze how despite our best efforts to use engineering design principles sometimes the results may not be perfect.

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3. Mirror, Mirror

    Demonstrate the engineering design steps by designing an innovation.

    Analyze tools to use (journals, surveys) and the importance documenting how problems are solved via the engineering design process to avoid malfunctions and patent infringement.

    Develop an Engineering Design Journal to practice using the EDJ Process to design technology innovations.

    Re-Design in teams an existing technology.

    Utilize tools such as computer aided design software and other modeling tools to provide twodimensional and threedimensional representations of technology innovations/solutions.

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3. **Project Revive: Revitalizing Communities Using Existing Models**

    1. Disaster Driven Problems Examine how communities often must be re-developed due to not only natural disasters but also human-made disasters which often impacts humans' attitudes and choices about technology's development.

        Determine whether new technologies need to be developed or if modifying existing products would the best alternative/solution.

        Utilize various tools to help gather data to evaluation the positive and negative effects of current technologies that may need modification

        Analyze the data collected regarding the extent of the disaster using a variety of communication technologies such as GPS, data tables using with spreadsheets, databases, graphs and charts.

        Interpret by evaluation if the information obtained is accurate and useful for the purpose of determining various impacts of the disaster. (how much clean up needed, how many shelters, which tools needed for repair…)

    2. What is Next? Finding Alternatives/Solutions

        Examine existing models of revitalized and artificially designed communities including the International Space Station and eco-house designs

        Examine artificial eco systems made by humans to replicate natural environments that may be useful models for redeveloping ecosystems altered or destroyed by disasters.

        Brainstorm respectfully in teams to derive alternatives for the design of a community that will be revitalized including eco-friendly solutions. to derive solutions that involves designs that have proved to not be "perfect". (not to be restricted to one's own ideas)

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3. Designing Solutions

    Research to Identify the various areas needed to be addressed to provide the best solutions to meet the needs to revitalize a community utilizing advances in all of the different technologies such as medical, agricultural/related biotechnologies (including sanitation processes, refrigeration, dehydration, and preservation to provide long term storage and reduce health risks) energy/power, transportation and construction technologies.

    Develop the criteria and constraints for a given design solution.

    Apply the design process to document how solutions will be best implemented

    Design CAD and/or sketched visualizations that would communicate to others how the design solution would be modeled to be eventually manufactured

4. Producing Engineering Design Technology Solutions

    Produce various solutions to create a model of a revitalized community by engineering design for each of the technologies impacted. (metric used in all other countries).

    Determine the several subsystems necessary to build temporary and permanent community resources such as bathrooms, shelters, water usages that are practical and environmentally-friendly forms of technology.

    Produce a model of a revitalized community using a mock building code manual that can be used for a prototype considering how different communities/countries use different units of measurement.

    Test, Redesign, and Present solutions with models with opportunity to for audience feedback.

    Examine and determine the subsystems of an eco-house

    Debate solutions to address future world concerns using technologies.

Invention and Innovation

1. **Introduction to Invention and Innovation**

    Describe new products and systems that have been developed to solve problems. Identify new products and systems that cannot be done without the help of technology.

    Explain that the development of technology is a human activity and is the result individual or collective needs and the ability to be creative.

    Explain how technology is closely linked to creativity. Discuss how creativity has resulted in innovations to technology.

    Identify corporations that have created a demand for a product through marketing and advertising.

    Differentiate between trade-offs in the decision making process. Formulate careful compromises when deciding which trade-offs are acceptable.

    Design a product, system or environment for a specific setting. Examine unrelated settings where their product, system or environment may be applied.

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Identify recent innovations to products or systems that have led to changes in society. Describe inventions or innovations that changed society and created new needs and wants.

Select a technological device and analyze the social and cultural priorities and values reflected by that device.

Examine societal expectations that have boosted the acceptance and use of a product or system.

Examine the slow, methodical processes of tests and refinements as they relate to the evolution of inventions and innovations.

Design a technological improvement for a device that has a highly specialized function.

Indentify an invention or innovation that was developed without the knowledge of science.

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2. **Invention and Innovation of the Designed World**

Describe new products and systems that have been developed to solve problems. Identify new products and systems that cannot be done without the help of technology.

Explain that the development of technology is a human activity and is the result individual or collective needs and the ability to be creative.

Explain how technology is closely linked to creativity. Discuss how creativity has resulted in innovations to technology.

Identify a malfunction of a part of a system that affects the function and quality of the system. Develop a plan to repair a malfunction of a part of a system that affects the function and quality of the system.

Design a product or system that adheres to certain parameters.

Recognize the design process as a creative planning process. Demonstrate the steps of the technological design process to design a product or system.

Evaluate the design of a product or system and highlight the imperfections of that design.

Differentiate between the criteria and constraints of a product or system. Explain how the criteria and constraints become the requirements of a design.

Create, using the design process, an original device or system from their own ideas and imagination. Create, using the design process, an innovation to an existing product or system to improve it.

Develop a series of experiments to solve a technological problem.

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3. **The Engineering Design Process**

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Design a product or system using the technological design process. Describe the technological design loop and the path they follow when designing a product or system.

Describe the rules to follow when brainstorming with a group of people. Defend brainstorming as a viable technique when problem solving.

Explain how ideas can be transformed in to practical solutions. Formulate a plan to model, test, evaluate, and modify a product or system.

Explain how troubleshooting can identify the cause of a malfunction in a technological system. Develop a plan to troubleshoot the cause of a malfunction in a technological system.

Design a product or system outside the classroom-laboratory using the technological design process.

Distinguish criteria and constraints for a design.

Formulate two-dimensional and threedimensional representations of a designed solution.

Evaluate and test a design in relation to preestablished requirements, such as criteria and constraints, and refine as needed.

Create a product or system and document the solution.

Demonstrate the use of computers and calculators in various applications. Differentiate between the computer or calculator when performing various applications.

Explain how biotechnology applies the principles of biology to create commercial products or processes. Argue the ethical considerations of using biotechnology to create commercial products and processes.

Explain that the use of symbols, measurement, and drawings provides a common language to express ideas. Demonstrate the use of symbols, measurement, and drawings to promote clear communication.

Explain how chemical technologies modify or alter chemical substances. Compare the characteristics of two chemical elements with the altered characteristics of their resulting compound.

Explain that marketing involves informing the public, selling and distributing a product or system. Develop a marketing campaign to inform the public about a product or system.

4. **Design and Creativity**

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5. **Technology and Society**

Describe three instances where technological systems interact with each other.

Design a product, system or environment for a specific setting. Explain how a product, system, or environment developed for one setting may be applied to another setting.

Compare technological decisions about products or systems that have had both desirable and undesirable consequences. Identify the ethical issues related to the development and use of technology. Defend the ethical issues related to the development and use of technology.

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Identify economic, political and cultural issues that are influenced by the development and use of technology. Support an economic, political or cultural issue that is influenced by the development and use of technology.

Describe a technology that is used to repair damage caused by natural disasters. Describe a technology that is used to break down waste from the use of a product or system.

Identify examples of decisions to develop and use technology that puts environmental and economic concerns in direct competition with one another.

Support an environmental or economic concern resulting from the development and use of technology that places them in direct competition with one another.

Identify recent innovations to products or systems that have led to changes in society. Describe inventions or innovations that changed society and created new needs and wants.

Select a technological device and analyze the social and cultural priorities and values reflected by that device.

Examine societal expectations that have boosted the acceptance and use of a product or system.

Examine the slow, methodical processes of tests and refinements as they relate to the evolution of inventions and innovations.

Design a technological improvement for a device that has a highly specialized function.

Indentify an invention or innovation that was developed without the knowledge of science.

Examine collected data to analyze and interpret trends in order to identify positive and negative effects of a technology.

Describe government regulations that influence the design and operation of transportation systems.

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6. **Space Transportation (NASA)**

Compare technological decisions about products or systems that have had both desirable and undesirable consequences. Explain that systems fail because they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with.

Defend the ethical issues related to the development and use of technology Identify and describe examples of how technology affects humans.

Support an economic, political or cultural issue that is influenced by the development and use of technology. Identify, explain, and evaluate what explorers will do on the Moon and the scientific and economic reasons for establishing a lunar outpost. Explain that all technologies have effects other than those intended by the design, some of which may have been predictable and some not. Describe, analyze, and evaluate the impacts that inventions and innovations have had on humans. Identify and describe the reasons for further exploration of the Moon.

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Describe, analyze, and evaluate a technology that is used to repair damage caused by natural disasters. Describe, analyze, and evaluate a technology that is used to break down waste from the use of a product or system.

Support an environmental or economic concern resulting from the development and use of technology that places them in direct competition with one another.

Select a technological device and analyze the social and cultural priorities and values reflected by that device.