Technology Education Grade 6 – Exploring Technology

(10 Week course)

Course Description

In Exploring Technology, students develop an understanding of the progression and scope of technology through exploratory experiences. In group and individual activities, students experience ways in which technological knowledge and processes contribute to effective designs and solutions to technological problems. Students participate in design activities to understand how criteria, constraints, and process affect designs. Brainstorming, visualizing, modeling, constructing, testing, and refining designs provide firsthand opportunities for students to understand the uses and impact of innovations. Students develop skills in communicating design information and reporting results. This course is a cornerstone for a middle school technology education program.

Students will:

- Demonstrate an understanding of technology and its systems and how they affect the areas of production, communication, and transportation.
- Recognize the scope of technology and evaluate the impact and consequences technology has on society, culture, and the environment.
- Investigate ideas and develop research skills to address technology-related needs and problems and to design and construct technology-based products.
- Apply science, mathematics, language arts, and technological concepts to solve real-world problems.
- Use technology resources, processes, and tools safely and effectively.
- Demonstrate a general understanding of technology-based roles and careers including engineers, technologists, technicians, and craftspeople.

Attributes & Attitudes:

- Assist students in developing insight, understanding and the safe application of technological concepts, processes and systems
- Develop lifelong learning skills, creative abilities, positive self-concepts, life skills and individual potential in technology through group work
- Develop student creative-solving and decision-making abilities involving human and material resources, processes and technological systems
- Provide activity-oriented laboratory instruction that reinforces abstract concepts with tangible experiences
- Integrate and reinforce all school curriculum areas that interact with technology
- Convey fundamental knowledge about the development of and changes in technology and its effect on people, the environment and culture
- Assist students with career development and exploration concepts and plans

Course Goals:

Standard I

Develop an understanding of the characteristics and scope of technology

- Nature of technology – New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
- Rate of technological diffusion – The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.
- Goal-directed research – Technology is closely linked to creativity, which has resulted in innovation.

Standard II

Develop an understanding of the core concepts of technology

- Systems – Technological systems include input, processes, output, and, at times, feedback
- Resources – Resources are the things needed to get a job done, such as tools and machines, materials, information, energy, people, capital, and time.
- Requirements – Requirements are the parameters placed on the development of a product or system.
- Optimization and Trade-offs – Trade-off is a decision process recognizing the need for careful compromises among competing factors.
- Processes - Many inventions and innovations have evolved using slow and methodical processes of tests and refinements.
- Controls – Controls are mechanisms or particular steps that people perform using information abut the system that causes systems to change.

Standard III

Develop an understanding of the relationships among technologies and the connections between technology and other fields of study

- Technology transfer – Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.
- Innovation and invention – Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
- Knowledge protection and patents – Technological ideas are sometimes protected through the process of patenting.
- Technological knowledge and advances of science and mathematics and vice versa – Technological progress promotes the advancement of science and mathematics.

Standard IV

Develop an understanding of the influence of technology on history

- Evolutionary development of technology – Most technological development has been evolutionary, the result of a series of refinements to a basic invention.
- Dramatic changes in society – The evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
- History of technology - Throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape.
- Early technological history – Early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.

Standard V

Develop an understanding of the attributes of design

- The design process – Design is a creative planning process that leads to useful products and systems.
- Design problems are usually not clear – There is no perfect design.
- Designs need to be refined – The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.
- Requirements – Requirements of a design are made up of criteria and constraints.

Standard VI

Develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

- Research and development – Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.
- Researching technological problems – Some technological problems are best solved through experimentation.
- Not all problems are technological or can be solved – Technology cannot be used to provide successful solutions to all problems or to fulfill every human need or want.
- Multidisciplinary approach – Depending on the nature of a problem, a wide range of knowledge may be required.

Course Outline:

Unit 1 Technological Innovation

I. Definitions & Examples
   A. Invention – The development of a new product that has never existed
   B. Innovation – Improvements or changes made to existing products
   C. Discovery – Looking for new relationships and properties of materials

II. Sketching for Communications
   A. Purpose of sketching
   B. Sketching lines, shapes, and forms
   C. Sketching two-dimensional and three-dimensional objects
   D. Computerized Sketching using a CAD program.

IV. Impacts and Consequences
(Nuclear Power for example)
   A. Desirable – Good results (More electricity, safer country)
   B. Undesirable – Results can be dangerous or harmful to the environment or individuals (Radioactive waste, global danger)
   C. Planned – Certain impacts were anticipated initially, whether they were good or bad (more jobs, save natural resources)
   D. Unplanned – Impacts that were not anticipated occurred, sometimes for the food and sometimes for the bad (harmful effects to the environment)

V. Impacts of Inventions and Innovations
   A. Societal – Faster transportation, telecommunications, easier access to food and supplies
   B. Personal – Improved sight, improved health, warmer houses.
   C. Ecological – More smog, greenhouse effect, recycling, more efficient use of resources.

Academic Connections:

Mathematics

1. Scale/Proportion – When sketching, students need to be able to determine the size of an object if it is to appear larger or smaller than its actual size. Ratios, fractions, and basic multiplication are necessary understandings for this topic.
   a. http://www.iit.edu/~smile/ma8809.html - Learning ratios and proportions through scale drawings.
2. Coordinates – As objects are sketched in a three-dimensional area, students should be able to distinguish between the X, Y, and Z-axes. A review of Cartesian coordinates may be necessary.
   a. http://mathworld.wolfram.com/CartesianCoordinates.html - Eric Weisstein's World of Mathematics

Science

1. Discoveries – Most changes in technology are the result of inventions or innovations whereas discoveries are usually scientifically based. Some scientific discoveries should be discussed when introducing the lesson.
   a. http://www.doe.gov/educate/eduus.htm - Listing of scientific discovery museums in the United States
2. Environmental Impacts – The premise that technology causes changes also infers that there are impacts that sometimes affect the environment. Students should know what types of environmental changes have occurred in their community.

Social Studies

1. Inventions and Inventors – Changes caused by certain inventions have had profound impacts on society. How these inventions have changed the way people live, work, travel, and relax have many societal implications.
   a. http://inventors.about.com/library/bl/bl12.htm - About inventors and inventions
2. Geography – Transportation is quicker and safer and the world is "smaller."

a. http://www.si.edu/resource/Faq/nmah/transportation.htm – The geography of primitive transportation.
b. http://en.wikipedia.org/wiki/Timeline_of_transportation_technology - An extensive transportation timeline.

Language Arts

1. Sketches, Logs, Journals, or Portfolio – Students need to make written descriptions and annotations on their designs and ideas to further clarify the intended meaning and function.
   a. http://www.adprima.com/student_portfolios.htm - Basic information about developing student, teacher and electronic portfolios.
2. Class Presentations – For the benefit of all class members, students should present the information they find about a particular inventor or invention. This will necessitate introducing students to basic speech protocol such as eye contact, speaking loudly, and speaking slowly.
   a. http://www.abacon.com/pubspeak/ - Public Speaking website by Allyn Bacon
   b. http://www.toastmasters.org/tips.asp - Tips for giving a presentation by Toastmasters

Unit 2 Technological Innovation

I. Definitions & Examples
   A. Technology – Human innovation in action
      1. Applies problem-solving strategies to solve real-world problems
      2. Focus is on the human-made world
      3. Uses the design process to develop solutions
      4. Knowledge and skills deal with creating, using, managing, and assessing technology
   B. Science – The study of the natural world
      1. Applies methods of inquiry to answer questions
      2. Focus primarily on natural world
      3. Uses the scientific method to propose explanations
      4. Focus is on finding out "What is"
   C. Examples of how science and technology work together for a common solution
      1. Microscope – A technological device that is used for scientific experiments
      2. Magnetic Levitation Vehicle – A train (technology) that is suspended with superconductors (science)
      3. Sunspots – Science seeks to discover why sunspots occur and their potential impacts to the earthy by using technological devices such as a telescope, satellites, and computer imaging.
      4. Hip Replacement – Polymers and metals are used to reconstruct a person's hip while the scientific aspects of the human body are studies.
   D. Relationships between Technology and other subjects
      1. Social Studies and Technology
      2. Language Arts and Technology
      3. Art, Music, and Technology
      4. Mathematics and Technology
   E. Scope of Technology in the Designed World
      1. Transportation – The movement of people and goods from one location to another
      2. Energy and Power – Providing the force needed to do work (energy) and determining the rate at which the work is being done (power)
      3. Informational – Using various technological devices to create, transmit, and interpret a message.
      4. Medical – Maintaining and improving the physical well being of people
      5. Construction – Designing and making structures such as roads, bridges, houses, shopping malls, tunnels, and cranes.
      6. Manufacturing – The production of goods
      7. Agricultural and Related Biotechnology – The manipulation and use of living organisms for various purposes, such as changing the form of food, improving health, or disposing of waste

II. Methods of Problem Solving
   A. Design Process – Solve technological problems by developing ideas into solutions
   B. Scientific Method – Propose explanations to questions in the natural world.
   C. Innovation Process – Create new and improved products

D. Troubleshooting/Debugging – Determine the reason a product or system does not function and correct it.

III. Resources of Technology

A. People
   1. Team work
   2. Leadership

B. Information
   1. Finding information
   2. Accessing information
   3. Using information

C. Materials
   1. Natural resources
   2. Synthetic materials

D. Tools
   1. Safety requirements
   2. Power tools
   3. Hand tools
   4. Machines

E. Energy
   1. Nonrenewable resources
   2. Renewable resources

F. Capital

G. Time

IV. The Design Process

(There are many models to use for this process and this process may be adapted to meet specific needs. It is recommended that whichever model is chosen, be used consistently in all courses.

A. Get to Know the Problem
   1. Conduct basic research related to the problem
   2. Ask other people about their ideas
   3. List requirements and limitations

B. Explore and Generate Ideas
   1. Brainstorm by listing ideas
   2. Make sketches with notes
   3. Examine similar products

C. Select One Idea
   1. Compare ideas against criteria and constraints
   2. Ask other people about the ideas
   3. Select the best one

D. Plan and Develop the Solution
   1. Make a plan to build the idea
   2. Create drawings from the sketches
   3. Make a model – A three-dimensional representation of an idea, full size or scaled
   4. Make a prototype – A full-size working product or system

E. Test and Evaluate
   1. Ask others what they think of the solution
   2. Test the solution to determine if it solves the problem
   3. Analyze the physical properties of the object

F. Redesign if Necessary
   1. Make changes based on the testing results
   2. Use feedback from others to make changes

G. Present the Solution
   1. Apply for a patent
   2. Make an advertisement
   3. Sell the product if applicable

Academic Connections:

When students solve a particular design problem, it is important that they make connections to other academic areas. It would be impossible to list all of the possible connections since there are such a variety of design problems available. A general description is given for each content connection cited below.

Mathematics

1. Testing a Solution – When testing a solution, students will need to make calculations to help determine if the solution is correct and safe.

Science

1. Scientific Inquiry Method – This process will need to be reviewed with the students so they realize that it differs in focus and procedure from the design process
    a. http://www.nceas.ucsb.edu/fmt/doc?/search/ - Basic information about the Scientific Method.
2. Resources – Many of the resources listed have scientific connections. Specifically, when studying materials students should realize that some are created naturally while humans make others.

Language Arts

1. Portfolio – As students develop their "Techfolio" or portfolio, they will net to use proper format, grammar, and spelling to document the work they have completed. In addition, identifying appropriate materials to use when researching a topic will need to be considered.
    a. http://www.adprima.com/student_portfolios.htm - Basic information about developing student, teacher, and electronic portfolios.

Rubber Band Vehicle

Name:_____
Period:_____
Date:_____

Introduction:

The Mayor of Technology City has decided that in addition to the annual CO2 Car Competition, there should be a Classic Car Competition with a twist. The "car" can hold only one person and must be powered from rubber bands.

A Problem to Solve:

Your team's Technology Challenge is to produce a functional smaller scale prototype that must travel at least six feet.

Procedures:

1. *The rubber band must part of the vehicle (no slingshots, etc.)*
2. *The vehicle must begin from a dead start (no throwing, etc.)*
3. *Each member of the team must demonstrate the vehicle in operation.*
4. *You must work with someone you have not worked with before*
5. Make a rough sketch of your design.
6. Make a final drawing
7. Construct your vehicle
8. Complete a Technical Data Report.

ROUGH SKETCH

FINAL SKETCH

Resources You Will Need

Materials:

You will be limited to the Following materials:

⇒ **Paper**

⇒ **Scrap wood**

(2) $\frac{1}{4}$" x 5" dowel rod

⇒ **(3) three rubber bands – your** choice of size

⇒ **Up to 24" of string**

⇒ (3) three materials of your choice

⇒ Unlimited fasteners

Equipment:

⇒ **Pencil or pen**

⇒ **Saws (hand)**

⇒ **Tools**

⇒ **Drill press or hand drill**

Performance Evaluation

Neatness = 5 points

Travel: 6' = 10 points, with 1 point for each additional foot

Travel accuracy: straight = 10 points; each foot off = -1 point

Technical Data Report: Must be filled out by each member = 10 points

Technical Data Report

1. What the vehicle is designed to do:

   _____

   _____

   _____

2. Construction sequence (1 point for each – correctly spelled):

   _____

_____
_____
_____
_____
_____

3. Problems your team had and how you solved them:

_____
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What Did You Learn

1. Problem solving begins by identifying the problem. In this activity, what was the problem?

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2. What goals did you set? What specifications did you have?

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3. What alternative solutions did you come up with?

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4. Why did you choose your solution?

5. What feedback did you receive? How would you change your solution for the next time?

6. Lubricants help reduce friction. Are there areas of your vehicle where you could apply lubricating compounds? What type of lubricant would you use?

7. Increasing the weight of parts of your vehicle may give you an advantage. How will this help? What vehicles are designed with weighted subsections?