

# Technology, Engineering and Design

## Unit 1: Technological Innovations and Inventions

### Class Notes – Mr. Dion

**Big Idea:** Inventions and Innovations are a result of evolutionary technological development and systematic research and development.

#### Key concepts:

1. Most inventions and innovations are the result of an evolutionary process where a series of refinements leads to an improvement in a technological device. (1.1)
2. New technologies create new processes and a change in technology can change the process of creating a product. (1.2)
3. Many factors—including advertising, the strength of the economy, goals of the company, and fads determined by society—have an impact on the demand and design of technology. (1.3)
4. Research and Development is a problem-solving approach used by companies to prepare products and services for the marketplace. (1.4)

#### Unit Vocabulary:

- **Technology** - Human innovation that involves the generation of knowledge and process to develop products that solve problems and extend human capabilities. Anything that was created to solve a human's problem.
- **Technology Evolution** - A series of refinements to an invention that leads to an improvement in a technological device or product.
- **Invention** – Creation of a product or introduction for the first time.
- **Innovation** - An improvement of an existing technological product (invention), process, or service.
- **Impacts of technology** – The impacts of technology can be both expected and unexpected. Technology can have both positive and negative impacts.
- **Tradeoffs** – When the positive impacts of technology outweigh the negative ones.
- **Product** - A tangible artifact or service that allows humans to experience the impacts of technology.
- **Technology Transfer** - Occurs when a new user applies an existing technology developed for one purpose in a different function.
- **Process** – A list of actions used to develop a product or service. Includes a definition of materials and the steps required to build the deliverable.
- **Development** – Process used to convert knowledge and materials into a physical form.
- **Research and Development (R&D)** – A specific problem-solving approach that is used intensively in business and industry to prepare products and services for the marketplace.
- **Advertising and Marketing** – Methods used to make the consumer aware of a product or service for purchase. Television commercials, radio ads, social media sites and billboards are all examples of advertising.

- **Patent** – Government program to protect a person or group’s Intellectual Property (IP). Inventors must include a text description of their idea, a rough sketch describing the invention and dated signatures on a patent application.

## Lesson 1: Inventions & Innovations: An Evolutionary Process

**Big Idea:** Inventions and innovations are the result of an evolutionary process through a series of improvements and refinements.

### **Key Concepts:**

1. Interpretation of charts and graphs that illustrate the rapidly increasing rate of technological development and diffusion. Approximate and interpret rate of change from graphical and numerical data.
2. Most technological development has been evolutionary, the result of a series of refinements to a basic invention.
3. Identify the evolutionary history of a technological device, specifically mentioning the original inventions and the series of refinements to that invention that led up to the given technological device.

### **Common examples of technological evolution:**

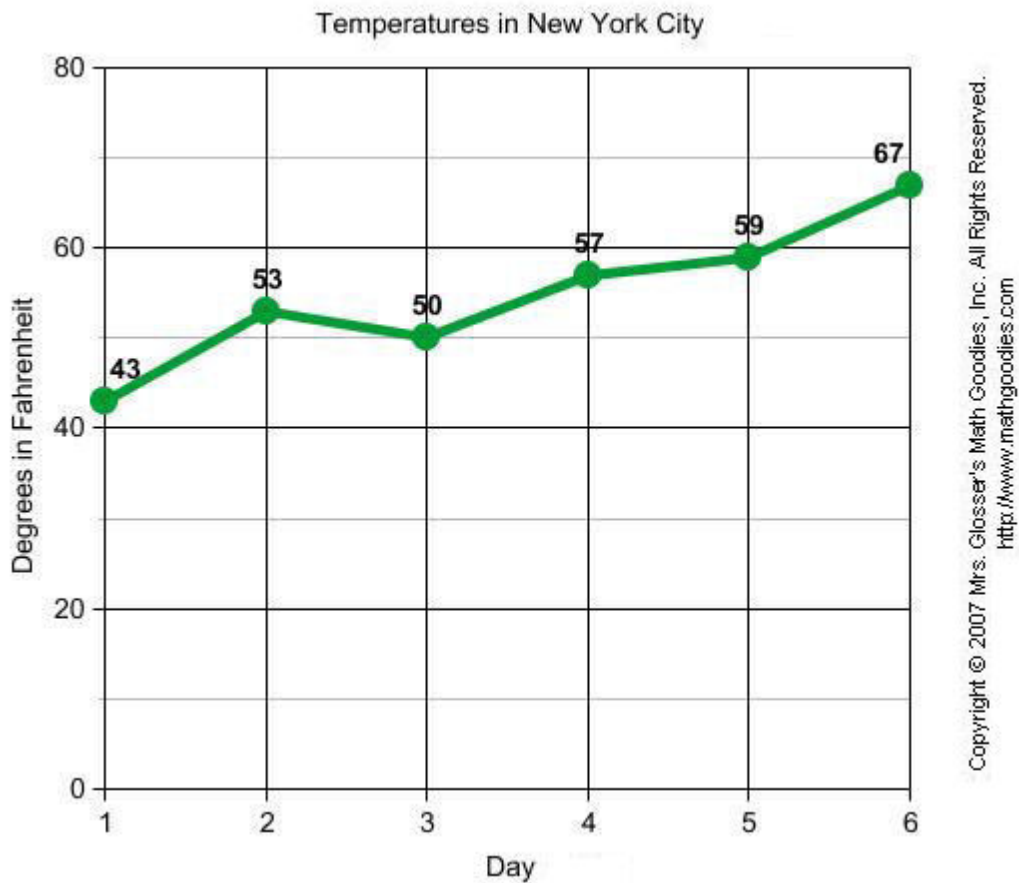
- **The automobile** –
  - In 1901, the Olds automobile factory began production with a three-horsepower Oldsmobile for \$650. (**original invention**)
  - In 1902, standard brake drums were invented, the basis for today’s disc brakes.
  - In 1908, Henry Ford mass-produced the Model T Ford.
  - In 1911, the electric starter was invented.
  - In 1914, Dodge introduced the first full-steel body.
  - In 1919, the first single pedal to operate the four-wheel brakes was added.
  - In 1926, the first power steering system using hydraulics became available.
  - In 1939, the first air conditioning units were added.
  - In 1966, a electronic fuel injection system was developed in Britain.
  - In 1992, the government supports alternative- energy-fuel vehicles.
- **The computer** – The original invention that led to the computer was a mechanical calculator called the **abacus**. Computers have become invaluable in science, mathematics, and technology because they speed up and extend people’s ability to collect, store, compile, and analyze data; prepare research reports; and share data and ideas with investigators all over the world.

## Interpreting graphs and data:

Example 1: The table below shows daily temperatures for New York City, recorded for 6 days, in degrees Fahrenheit.

Temperatures In NY City	
Day	Temperature
1	43° F
2	53° F
3	50° F
4	57° F
5	59° F
6	67° F

The data from the table above has been summarized in the line graph below.



Let's define the various parts of a line graph.

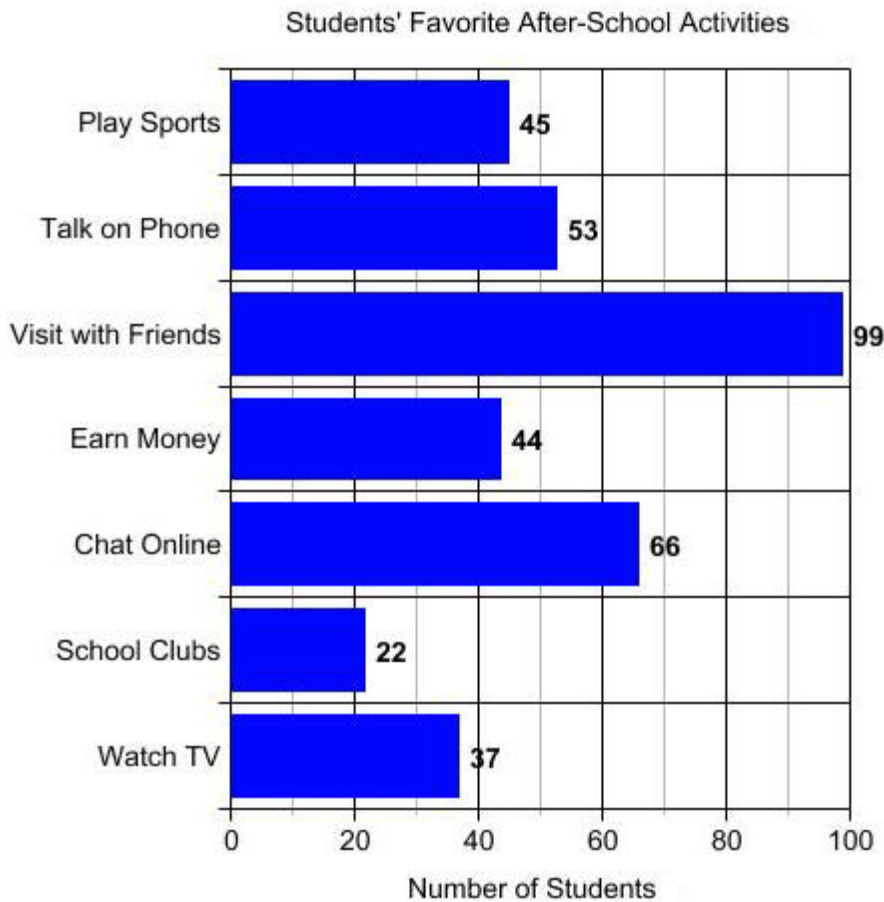
<b>title</b>	The title of the line graph tells us what the graph is about.
<b>labels</b>	The horizontal label across the bottom and the vertical label along the side tells us what kinds of facts

	are listed.
<b>scales</b>	The horizontal scale across the bottom and the vertical scale along the side tell us how much or how many.
<b>points</b>	The points or dots on the graph show us the facts.
<b>lines</b>	The lines connecting the points give estimates of the values between the points.

Example 2: A survey of students' favorite after-school activities was conducted at a school. The table below shows the results of this survey.

<b>Students' Favorite After-School Activities</b>	
<b>Activity</b>	<b>Number of Students</b>
Play Sports	45
Talk on Phone	53
Visit With Friends	99
Earn Money	44
Chat Online	66
School Clubs	22
Watch TV	37

Note that since the data in this table is not changing over time, a line graph would not be a good way to visually display this data. Each quantity listed in the table corresponds to a particular category. Accordingly, the data from the table above has been displayed in the bar graph below.



Copyright © 2007 Mrs. Glosser's Math Goodies, Inc. All Rights Reserved.  
<http://www.mathgoodies.com>

A **bar graph** is useful for comparing facts. The bars provide a visual display for comparing quantities in different categories. Bar graphs help us to see relationships quickly. Another name for a bar graph is a bar chart. Each part of a bar graph has a purpose.

<b>title</b>	The title tells us what the graph is about.
<b>labels</b>	The labels tell us what kinds of facts are listed.
<b>bars</b>	The bars show the facts.
<b>grid lines</b>	Grid lines are used to create the scale.
<b>categories</b>	Each bar shows a quantity for a particular category.

## Lesson 2: Technological Effects on New Processes

**Big Idea:** New technologies affect how things are invented, produced, and used.

**Key Concepts:**

1. New technologies are used to create new processes. A good example of this is how robots have changed the automobile manufacturing process.
2. Technology transfer takes place when a new user applies an existing technology developed for one purpose in a different function.
3. All technologies have effects other than those intended by the design, some of which may have been predictable and some not.
4. Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups.

### **Common examples of technology transfer:**

- **The geodesic dome** – The original invention was used for efficient dome shaped buildings. The design was transferred to another use by Buckminster Fuller when he patented a new improved soccer ball.
- **NASA** - Many technologies developed by NASA for use in its aerospace program become used for common products here on Earth. They include:
  - Cooling suits
  - Insulation for pipelines
  - Flame resistant textiles.
  - Crash test dummies
  - Fire fighter self-contained breathing devices
  - Adjustable patient harnesses.

## **Lesson 3: Advertising and Marketing Effects on Technology**

**Big Idea:** Many factors—including advertising, the strength of the economy, goals of the company, and fads determined by society—have an impact on the demand and design of technology.

### **Key Concepts:**

1. A number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of, demand for and the success or failure various technologies.
2. The patenting process that is sometimes used to protect technological ideas.
3. Technology may have effects other than those intended by the design, some of which may have been predicable and some not.
4. The value of any given technology may be different for different groups of people and at different points in time.

### **Impacts of Technology:**

Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment. All technologies have effects other than those intended by the design, some of which may

have been predictable and some not. Side effects of technologies may turn out to be unacceptable to some of the population and therefore lead to conflict between groups. The value of any given technology may be different for different groups of people and at different points in time. Companies must understand that societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.

Technology impacts the routines of daily living, the ways people provide for their livelihood, the ways they interact with other people, and the course of history. Technology impacts the way people earn a living. All human affairs are impacted by technology.

- Technological ideas are sometimes protected through the process of patenting.
- Technological progress promotes the advancement of science and mathematics.
- Developments in science or technology often stimulate innovations in mathematics by presenting new kinds of problems to be solved.
- Developments in mathematics often stimulate innovations in science and technology.
- Technology directly affects society, versus science, because it solves practical problems and serves human needs.

## Lesson 3: The Role of Research and Development: A Problem Solving Approach

**Big Idea:** Research and development is a problem-solving approach that allows businesses and industry to prepare products and systems for the marketplace.

### **Key Concepts:**

1. Research and Development is a specific problem-solving approach that is used intensively in business and industry to prepare products and services for the marketplace.
2. Because the development of technologies is driven by the profit motive and the market, many companies have a Research and Development (R&D) department, whose responsibility is to work with innovations.
3. Companies use Research and Development for two purposes:
  - To understand improvements to existing products.
  - To define completely new products.
4. Research and Development Steps:
  - Technology/Product need is identified
  - Prototype testing and development
  - Marketing considerations
  - Optimization
  - Product documentation developed
  - Manufacturing considerations
  - Full-scale production

- Release product