

Technology Systems – A Standards-Based Middle School Model Course Guide

Unit 2

Technology Systems: Impacts and Issues

Overview

Unit 1 Big Idea – Information about the performance of technology systems can be collected and analyzed in order to identify positive and negative impacts.

Synopsis - The use of technology systems affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. In this unit, student will identify trends and monitor potential consequences of technological development. They will gain an awareness of how technology has influenced the great revolutions in agriculture, manufacturing, sanitation and medicine, warfare, transportation, information processing, and communications that have radically changed how people live.

Lesson 1 – Impacts of Technology Systems

Lesson 2 – Data Acquisition and Analysis

Lesson 3 – Trends and Consequences

Standards

- Students will develop an understanding of the cultural, social, economic and political effects of technology. (ITEA Standards for Technological Literacy - Standard 4)
- Students will develop an understanding of the effects of technology on the environment. (ITEA Standards for Technological Literacy - Standard 5)
- Students will develop an understanding of the role of society in the development and use of technology. (ITEA Standards for Technological Literacy - Standard 6)
- Students will develop the abilities to assess the impact of products and systems. (ITEA Standards for Technological Literacy - Standard 13)
- The Nature of Science (AAAS Benchmarks for Science Literacy, Chapter 1)
- The Nature of Mathematics (AAAS Benchmarks for Science Literacy, Chapter 3)
- The Structure of Matter (AAAS Benchmarks for Science Literacy, Chapter 4)
- The Mathematical World (AAAS Benchmarks for Science Literacy, Chapter 9)
- Communication Standard Grade 6-8 (NCTM - Principles and Standards for School Mathematics)
- Problem Solving Standard Grade 6-8 (NCTM - Principles and Standards for School Mathematics)

Benchmarks

ITEA – Benchmarks for Technological Literacy

- The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. (STL - 4D)
- The management of waste produced by technological systems is an important societal issue. (STL – 5D)

- Technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems. (STL – 5E)
- Decisions to develop technologies often put environmental and economic concerns in direct competition with one another. (STL-5F)
- Social and cultural priorities and values are reflected in technological devices. (STL – 6F)
- Design and use instruments to gather data. (STL – 13F)
- Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. (STL – 13G)
- Identify trends and monitor potential consequences of technological development. (STL - 13H)
- Interpret and evaluate the accuracy of information and determine if it is useful. (STL – 13I)

AAAS-Benchmarks for Science Literacy

- Computers have become invaluable in science 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. (AAAS - 1C)
- New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks. (AAAS-3C)
- Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters entirely in favor of one side or another. That is because the contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be. (AAAS-3C)
- 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. (AAAS-3C)
- Technology has strongly influenced the course of history and continues to do so. It is largely responsible for the great revolutions in agriculture, manufacturing, sanitation and medicine, warfare, transportation, information processing, and communications that have radically changed how people live. (AAAS-3C)
- Energy cannot be created or destroyed, but only changed from one form into another. (AAAS 4F)
- Mathematical statements can be used to describe how one quantity changes when another changes. (AAAS 9B)

NCTM-Standards for School Mathematics

- Recognize and apply mathematics in contexts outside of mathematics. (Connections Standard Grade 6-8, NCTM)
- Apply and adapt a variety of appropriate strategies to solve problems. (Problem Solving Grade 6-8, NCTM)
- Use the language of mathematics to express mathematical ideas precisely. (Communication Grade 6-8, NCTM)

Learning Objectives - Students will learn to:

1. Apply and adapt a variety of appropriate mathematics strategies to solve problems.
2. Cite an instance where decisions to develop technologies put environmental and economic concerns in direct competition with one another.

3. Describe how technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems.
4. Explain how decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
5. Explain that computers have become invaluable in science 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.
6. Explain that technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.
7. Explain that the management of waste produced by technological systems is an important societal issue.
8. Identify and describe a situation where technology influenced the course of history.
9. Identify and describe an instance where social and cultural priorities and values are reflected in technological devices.
10. Identify positive and negative impacts of selected technologies.
11. Identify the various ways in which the use of technology affects humans including their safety, comfort, choices, and attitudes about technology's development and use.
12. Identify trends and monitor potential consequences of technological development.
13. Identify types of data useful in assessing the other impacts of this technology system.
14. Interpret and evaluate the accuracy of information and determine if it is useful.
15. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology.
16. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology.
17. Use instruments to gather data.

Student Assessment

(See assessment instruments at end of lesson)

1. Selected Response Items
2. Brief Constructed Response Items
3. Performance Rubrics

Assessment Instrument – Unit 2

Category	Below Target	At Target	Above Target
Impacts of Technology Systems	Fails to explain that information about the performance of technology systems can be collected and analyzed in order to identify positive and negative impacts.	Explains that information about the performance of technology systems can be collected and analyzed in order to identify positive and negative impacts.	Explains and provides examples where information about the performance of technology systems can be collected and analyzed in order to identify positive and negative impacts.
Impacts and Issues	Cannot cite instances where the use of technology affects humans in various ways.	Cites multiple instances where the use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.	Describes in detail how the use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.

Data Acquisition and Analysis	Does not use of instruments to gather data regarding the impacts of technology systems effectively.	Uses of instruments to gather data regarding the impacts of technology systems.	Demonstrates creativity in the use of instruments to gather data regarding the impacts of technology systems.
Trends and Consequences of Technology System Use and Development	Fails to identify situations where data can be collected and analyzed in order to identify positive and negative impacts of a technology.	Identifies situations where data can be collected and analyzed in order to identify positive and negative impacts of a technology.	Describes how data can be collected and analyzed in order to identify positive and negative impacts of a technology.

Unit 2 - Technology Systems: Impacts and Issues

Pre-Test

Place the letter of the best answer in the box to the left of statement.

1	Information about _____ can be collected and analyzed in order to identify positive and negative impacts. A. technology systems B. workers C. equipment D. procedures
2	The management of _____ produced by technological systems is an important societal issue. A. designs B. theories C. inputs D. waste
3	Engineers use _____ to express ideas precisely. A. scientific instruments B. the language of mathematics C. the design process D. computers
4	They have become invaluable in science 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. A. Trade-offs B. Outputs C. Computers D. Requirements
5	They influence what aspects of technology are developed and how these are used. A. Corporations B. Societies C. Scientists D. Engineers

Unit 2 - Technology Systems: Impacts and Issues

Pre-Test (Answers)

Question No.	Answer
1	A
2	D
3	B
4	C
5	B

Unit 2 - Technology Systems: Impacts and Issues

Unit Test

Place the letter of the best answer in the box to the left of statement.

1	Information about _____ can be collected and analyzed in order to identify positive and negative impacts. A. technology systems B. workers C. equipment D. procedures
2	The use of _____ affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. A. artificial intelligence B. telecommunications C. technology systems D. calculators
3	The management of _____ produced by technological systems is an important societal issue. A. designs B. theories C. inputs D. waste
4	Technologies can be used to _____ caused by natural disasters. A. repair damage B. establish blame for damage C. locate damage D. control damage
5	Engineers use _____ to express ideas precisely. A. scientific instruments B. the language of mathematics C. the design process D. computers
6	Decisions to develop technologies often put _____ concerns in direct competition with one another. A. design and societal B. societal and cultural C. safety and medical D. environmental and economic
7	They have become invaluable in science 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.

		<ul style="list-style-type: none"> A. Trade-offs B. Outputs C. Computers D. Requirements
8		<p>Some of the same technologies that have improved the length and quality of life for many people have also brought new _____.</p> <ul style="list-style-type: none"> A. visual images B. storage devices C. inventions D. risks
9		<p>They influence what aspects of technology are developed and how these are used.</p> <ul style="list-style-type: none"> A. Corporations B. Societies C. Scientists D. Engineers
10		<p>People control technology and are responsible for its _____.</p> <ul style="list-style-type: none"> A. treatment B. effects C. maintenance D. resources

Unit 1 - Introduction to Technological Design

Unit Test (Answers)

Question No.	Answer
1	A
2	C
3	D
4	A
5	B
6	D
7	C
8	D
9	B
10	B

Unit 2 Lesson 1 Impacts and Issues

Lesson 1 Big Idea - The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.

Lesson Duration - Four (4) hours

Unit 2 – Impacts of Technology Systems

Big Idea – Information about the performance of technology systems can be collected and analyzed in order to identify positive and negative impacts.

Standards

- Students will develop an understanding of the cultural, social, economic and political effects of technology. (ITEA Standards for Technological Literacy - Standard 4)
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Benchmarks

ITEA – Benchmarks for Technological Literacy

- The use of technology affects humans in various ways, including safety, choices, and attitudes about technology's development and use. (STL – 4D)
- The management of waste produced by technological systems is an important societal issue. (STL - 5D)
- Technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems. (STL – 5E)
- Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another. (STL – 5F)
- Social and cultural priorities and values are reflected in technological devices. (STL – 6F) (STL - 6F)

AAAS-Benchmarks for Science Literacy

- Technology has strongly influenced the course of history and continues to do so. It is largely responsible for the great revolutions in agriculture, manufacturing, sanitation and medicine, warfare, transportation, information processing, and communications that have radically changed how people live. (AAAS-3C)
- New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks. (AAAS-3C)
- 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. (AAAS-3C)

NCTM-Standards for School Mathematics

- Use the language of mathematics to express mathematical ideas precisely. (Communication Grade 6-8, NCTM)

Learning Objectives

Students will learn to:

1. Identify the various ways in which the use of technology affects humans including their safety, comfort, choices, and attitudes about technology's development and use.
2. Explain that the management of waste produced by technological systems is an important societal issue.
3. Describe how technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems.
4. Explain how decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
5. Identify and describe an instance where social and cultural priorities and values are reflected in technological devices.
6. Identify and describe a situation where technology influenced the course of history.

Student Assessment Tools and/or Methods

(See assessment instruments at end of lesson)

1. Selected Response Items
2. Brief Constructed Response Items
3. Performance Rubrics

Resource Materials

• **Print-Based Sources**

1. Fundamentals of Building Construction: Materials and Methods by Edward Allen and Joseph Iano, Wiley; 4 edition (2003) ISBN-10: 0471219037, ISBN-13: 978-0471219033
2. Building Green: A Complete How-To Guide to Alternative Building Methods by Clarke Snell and Tim Callahan, Lark Books (2005) ISBN-10: 1579905323, ISBN-13: 978-1579905323
3. Energy-Efficient Building by Editors of Fine Homebuilding (1999) ISBN-10: 1561583405, ISBN-13: 978-1561583409

• **Audio/Visual Materials**

1. How Do I: Energy Efficiency (2005) DVD-Video, NTSC Studio: How Do I Inc DVD Release Date: February 1, 2005 Run Time: 160 minutes ASIN: B000B5XPOM
2. Green is the Color of Money! DVD Case Study for a Sustainable High Performance Building, ASIN: B000RAAKJY

• **Internet Sites**

1. Article about the effectiveness of street sweepers at reducing the pollution to streams.
<http://www.stormwatercenter.net/Practice/121-Street%20Sweepers.pdf>
2. (Source: Pollution Prevention Fact Sheet: Parking Lot and Street Cleaning found at http://www.stormwatercenter.net/Pollution_Prevention_Factsheets/ParkingLotandStreetCleaning.htm on 08/04/07)
3. <http://www.raingardens.org/Index.php>

Purpose of Lesson: To identify impacts of technology systems and methods for reducing and eliminating the negative impacts.

5-E Lesson Plan

Engagement

1. The teacher will present students with the following scenario: Lightning Strikes Power Company has just announced plans to build a nuclear power plant in your town and will utilize water from the local river to cool the system.
2. The teacher will show a picture of a nuclear power plant and ask students to write down their thoughts about the idea and questions they would want answered about the plan.

Exploration

1. The teacher will invite students to share their thoughts and questions and tally them on the board as being positive or negative.
2. Students will view current data concerning the use and safety history of modern nuclear power plant.
3. The teacher will present a visual that describes the inputs, process, and outputs used in a nuclear power plant.
4. The students will describe how their opinion might have changed given this information.
5. The teacher will ask students to consider a similar scenario in which a movie theater will be built instead of a nuclear power plant and the river will be used as drainage for the roof and parking lot.
6. Students will describe how their feelings about this project may differ and what questions they would want answered.
7. The teacher will tally responses on the board as being positive or negative.
8. Students will work in small groups to categorize and list their concerns about the impacts of these two projects.

Explanation

- 1 Students will share their categories from the exploration activity and provide examples to the class during a discussion.
- 2 The teacher will explain that the use of technology affects humans in various ways including their safety, comfort, choices, and attitudes about technology's development and use.
- 3 The teacher will refer to the students' lists to identify other ways in which the use of technology affects humans. (ex. Environment, economy)
- 4 The teacher will explain that attitudes toward and knowledge about a product or system, along with their subsequent actions, vary greatly and are influenced by their moral, social, and political beliefs.
- 5 The students will provide and discuss examples of technology systems that have divided public opinion based on beliefs.
- 6 The teacher will explain that the management of waste produced by technological systems is an important societal issue.
- 7 The teacher and students will provide examples of current systems used to manage the waste produced by technology systems.

- 8 The teacher will explain how decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.
- 9 The teacher will explain how technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems.
- 10 The students will identify the waste products produced by a heavy rainfall on the movie theater/parking lot complex described above.
- 11 The teacher will review the formulas for area and volume of rectangular, triangular, and circular shapes.
- 12 Students will calculate the volume of water running off of a structure and analyze possible impacts using the lesson resource Hold Your Water. (See Student Resource 2.1.1)

Extension

1. Individually or in small groups students will identify a house or other building to analyze the rainwater runoff and propose a plan for mitigating its impact on the local stream. Solutions will include a detailed description of the impermeable surfaces, calculations of the water runoff, and recommendations for reducing the volume of water delivered to the storm drains in the street.
2. Students will deliver an oral report on their analyses.
3. The teacher will review research and reporting techniques and the evaluation criteria for the activity using the appropriate rubrics.

Evaluation

Students' knowledge, skills, and attitudes will be assessed using selected response items and rubrics for class participation, brief constructed responses, and for the oral presentation. The rubrics will be presented in advance of the activities to familiarize students with the expectations and performance criteria. They will also be reviewed during the activities to guide students in the completion of assignments. The teacher may wish to develop a collection of annotated exemplars of student work based on the rubrics. The exemplars will serve as benchmarks for future assessments and may be used to familiarize students with the criteria for assessment.

Laboratory-Classroom Preparation

The laboratory should provide a flexible, resource-rich, learning environment that includes areas for lecture and demonstrations, small group meetings, and research activities. The teacher will adapt the learning environment based on the requirements of the unit or lesson. For this lesson, areas for lecture and demonstration, design, small group meetings, and fabrication activities should be readied.

Tools/Materials/Equipment

- Computers with Internet access
- Reference books
- Calculators

Laboratory-Classroom Safety and Conduct

1. Students will use tools and equipment in a safe manner and assume responsibility for their safety as well as for the safety of others.
2. Students will demonstrate courtesy in regard to the ideas expressed by classmates and will show appreciation for the efforts of others.

Lesson Assessment Instruments

Assessment Instrument - Selected Response Item

Directions: Circle the T or F in the column to the left of each true (T) or false (F) statement.

- T** **F** 1. The use of technology affects humans in various ways, including safety, choices, and attitudes about technology’s development and use.
- T** **F** 2. Decisions to develop and use technologies seldom put environmental and economic concerns in direct competition with one another.
- T** **F** 3. Social and cultural priorities and values are not reflected in technological devices.
- T** **F** 4. The management of waste produced by technological systems is an environmental issue not an important societal issue.
- T** **F** 5. Technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems.
- T** **F** 6. Technology is largely responsible for the great revolutions in agriculture, manufacturing, sanitation and medicine, warfare, transportation, information processing, and communications that have radically changed how people live.
- T** **F** 7. New technologies increase some risks and decrease others.
- T** **F** 8. People cannot control technology (as well as science) and therefore are not responsible for its effects.
- T** **F** 9. A product, system, or environment developed for one setting may be applied to another setting.
- T** **F** 10. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.

Assessment Instrument – Brief Constructed Response Item

Write a one-paragraph answer. Include a strong topic sentence with good supporting details to support your answer.

- Identify and describe an instance where social and cultural priorities and values are reflected in technological devices.
- Identify and describe a situation where technology influenced the course of history.

Category	Below Target	At Target	Above Target
Understanding	Response demonstrates an implied, partial, or superficial understanding of the text and/or the question	Response demonstrates an understanding of the text and/or the question	Response demonstrates an understanding of the complexities of the text and/or the question
Focus	Lacks transitional information to show the relationship of the support to the question	Addresses the demands of the question	Exceeds the demands of the question
Use of Related Information	Uses minimal information from lectures, discussions, or texts to clarify or extend meaning	Uses some expressed or implied information from lectures, discussions, or texts to clarify or extend meaning	Effectively uses expressed or implied information from lectures, discussions, or texts to clarify or extend meaning

Assessment Instrument – Oral Presentation

Category	Below Target	At Target	Above Target
Organization	Audience has difficulty following presentation because student jumps around.	Student presents information in logical sequence which audience can follow.	Student presents information in logical, interesting sequence which audience can follow.
Subject Knowledge	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student is at ease with expected answers to all questions, but fails to elaborate.	Student demonstrates full knowledge (more than required) by answering all class questions with explanations and elaboration.
Graphics	Student occasionally uses graphics that rarely support text and presentation.	Student's graphics relate to text and presentation.	Student's graphics explain and reinforce screen text and presentation.
Mechanics	Presentation has three or more misspellings and/or grammatical errors.	Presentation has no more than two misspellings and/or grammatical errors.	Presentation has no misspellings or grammatical errors.
Eye Contact	Student occasionally uses eye contact, but still reads most of report.	Student maintains eye contact most of the time but frequently returns to notes.	Student maintains eye contact with audience, seldom returning to notes.
Elocution	Student's voice is low. Student incorrectly pronounces terms. Audience members have difficulty hearing presentation.	Student's voice is clear. Student pronounces most words correctly. Most audience members can hear presentation.	Student uses a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.

Student Resource 2.1.1

Hold Your Water! (hold_your_water)

Parking lots are notorious for funneling pollutants into our streams and groundwater. These pollutants include road salt, garbage, pesticides, cigarette butts and waste from automobiles such as oil and brake pad dust. Most of this does no real harm until a heavy rain carries it all into the drains and ultimately a stream or river.

The use of street sweepers can be a very effective way to reduce the amount of pollutants on a street surface. Examine the information below and complete the BCR.

The largest expenditures for street sweeping programs are in staffing and equipment. The capital cost for a conventional street sweeper is between \$60,000 and \$120,000. Newer technologies are higher than that, with prices approaching \$180,000. The average useful life of a conventional sweeper is about four years, and programs must budget for equipment replacement. Sweeping frequencies will determine equipment life, so programs that sweep more often should expect to have a higher cost of replacement.

Sweeper Type	Life (Years)	Purchase Price (\$)	O&M Cost (\$/curb mile)	Sources
Mechanical	5	75,000	30	Finley, 1996 SWRPC, 1991
Vacuum-assisted	8	150,000	15	Finley, 1996 Satterfield, 1991

Table 1 gives sweeper cost data for two types of sweepers: mechanical and vacuum-assisted. The table shows that while the purchase price of vacuum-assisted sweepers is significantly higher, the operation and maintenance costs are lower.

City	Labor	Equipment	Material and Services	Total
Livonia	\$23,840	\$85,630	\$5,210	\$114,680
Plymouth Township	\$18,050	\$14,550	\$280	\$32,880

Cost data for two cities in Michigan provides some guidance on the overall cost of a street cleaning program. Table 2 contains a review of the labor, equipment, and material costs for street cleaning for the year 1995 (Ferguson *et al.*, 1997). The average cost for street cleaning was \$68 per curb mile and approximately 11 curb miles per day were swept.

Assessment Instrument – Brief Constructed Response Item

Here Comes the Rain

Our new movie theater will be built on a wooded property adjacent to a small creek. The new, impermeable surfaces created by the building and parking lot will prevent water from soaking into the ground. Instead, it will be funneled into drains leading to the creek. Use the information provided below to calculate the amount of runoff (in gallons) generated by a 0.5 inch rain shower. Show your work! (answer 4167 gallons)

Theater Roof = 100 ft by 200 ft.

Parking lot = 200 ft by 400 ft

1 cubic foot = 7.481 gallons

Reducing Impacts

Street sweeping is only one method for reducing the amount of pollutants reaching our streams. Diverting and holding water using various methods can filter out the pollutants. One such method uses landscaping and plants to create **bioretention** sites and rain gardens. The size and composition of these plantings are based on the amount of water expected during a typical heavy rainstorm. In addition to filtering out pollutants, bioretention sites have additional benefits. They allow pavement-heated water to cool off before reaching the streams where increased temperatures can harm plants and animals. Bioretention sites also prevent streams from being inundated by unnaturally large flows that cause damaging erosion.

What other methods do you think property owners could use to reduce the impacts created by buildings and parking lots?

What is Bioretention?

Definition: An engineered process to manage stormwater runoff, using the chemical, biological and physical properties afforded by a natural, terrestrial-based community of plants, microbes and soil. Bioretention provides two important functions: (i) water quantity (flood) controls; and (ii) improve water quality through removal of pollutants and nutrients associated with runoff.

Unit 2 Lesson 2 Data Acquisition and Analysis

Lesson 2 Big Idea - The use of instruments to gather data can help us understand the impacts of technology systems.

Unit 2 – Impacts of Technology Systems

Big Idea – Information about the performance of technology systems can be collected and analyzed in order to identify positive and negative impacts.

Lesson Duration - Five (5) hours

Standards

- Students will develop an understanding of the cultural, social, economic, and political effects of technology. (ITEA Standards for Technological Literacy – Standard 4)
- Students will develop an understanding of the effects of technology on the environment. (ITEA Standards for Technological Literacy – Standard 5)
- Students will develop abilities to assess the impact of products and systems. (ITEA Standards for Technological Literacy – Standard 13)
- The Nature of Science (AAAS Benchmarks for Science Literacy, Chapter 1)
- The Structure of Matter (AAAS Benchmarks for Science Literacy, Chapter 4)
- The Mathematical World (AAAS Benchmarks for Science Literacy, Chapter 9)
- Problem Solving Standard Grade 6-8 (NCTM - Principles and Standards for School Mathematics)

Benchmarks

ITEA – Benchmarks for Technological Literacy

- The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology’s development and use. (STL 4D)
- Decisions to develop technologies often put environmental and economic concerns in direct competition with one another. (STL-5F)
- Design and use instruments to gather data. (STL – 13F)
- Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. (STL – 13G)
- Interpret and evaluate the accuracy of information and determine if it is useful. (STL – 13I)

AAAS-Benchmarks for Science Literacy

- Computers have become invaluable in science 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. (AAAS 1C)
- Energy cannot be created or destroyed, but only changed from one form into another. (AAAS 4F)
- Mathematical statements can be used to describe how one quantity changes when another changes. (AAAS 9B)

NCTM-Standards for School Mathematics

- Apply and adapt a variety of appropriate strategies to solve problems. (Problem Solving Grade 6-8, NCTM)

Learning Objectives - Students will learn to:

1. Explain that technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.
2. Cite an instance where decisions to develop technologies put environmental and economic concerns in direct competition with one another.
3. Use instruments to gather data.
4. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology.
5. Interpret and evaluate the accuracy of information and determine if it is useful.
6. Explain that computers have become invaluable in science 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.
7. Apply and adapt a variety of appropriate strategies to solve problems.
8. Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task.

Student Assessment Tools and/or Methods

(See assessment instruments at end of lesson)

1. Selected Response Items
2. Brief Constructed Response Items
3. Performance Rubrics

Resource Materials

- **Print-Based Sources**
 1. The Evolution of Technology by George Basalla, University Press (1989) ISBN-10: 0521296811, ISBN-13: 978-0521296816
 2. Science and Technology in World History: An Introduction by James E. McClellan and Harold Dorn, The Johns Hopkins University Press; second edition (2006) ISBN-10: 0801883598, ISBN-13: 978-0801883590
 3. How Wireless Works by Preston Gralla and Eric Lindley, Que; 2 edition (2005) ISBN-10: 0789733447, ISBN-13: 978-0789733443
- **Internet Sites**
 1. Assessing the impacts of technology, http://findarticles.com/p/articles/mi_m1510/is_n73/ai_11691989 (Key words: Impacts technology)
 2. Charting the Impacts of Information Technology, <http://www.nsf.gov/statistics/srs98905/htmstart.htm> (Key words: Impacts technology)
 3. Environmental Impacts of Technology. Instructional Outcome Objectives for Technology Education., http://www.eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_ERICExtSearch_SearchValue_0=EJ452502&ERICExtSearch_SearchType_0=eric_accno&accno=EJ452502 (Key words: Impacts technology)

Purpose of Lesson: To use instruments to collect useful data that can aid in decision-making.

5-E Lesson Plan

Engagement

1. The teacher will hold a basketball at eye level and ask students to verbally share their thoughts about how high it will bounce when dropped.
2. The teacher will repeat the question using a new tennis ball.
3. The teacher will ask students to sketch the setup for the following scenario.
4. Write down a prediction in which they restate the question in their answer.
5. If you place a tennis ball on a basketball and drop this stack on the ground, how high will the tennis ball bounce? A. Much higher than its original height B. Much lower than its original height C. To approximately its original height
6. The teacher will tally the predictions on the board based on a show of hands.
7. The teacher will invite a student to come up and conduct the experiment.
8. The students will add a statement to their sketch describing what actually happened.

Exploration

1. The teacher will ask students to discuss with their neighbors what they just observed and formulate a brief written explanation that will be shared with the class.
2. Students will share their explanations.
3. The teacher will explain that the bounce of a ball (or any object) depends on how “lively” the ball is, what surface it is dropped on, and whether or not the surface is moving (such as a tennis racquet).
4. The teacher will define terms and demonstrate tasks to be carried out in the “Alive and Bouncing” activity.
5. Students will complete the activity “Alive and Bouncing” and answer the associated questions. (See Student Resource 2.2.1)

Explanation

1. Students will compile the average coefficients of restitution on the board for each of the balls used.
2. The teacher will lead students in a discussion concerning the data and why there might be variations in their results. These may include variations in the bounce surfaces, differences between balls used, measurement error, and room noise.
3. The teacher will use a graph to show the relative slopes of the lines representing the time delay between successive bounces for each ball. A horizontal line (slope = 1) represents a ball with perfect elasticity and a vertical line (slope = 0) has no elasticity. The first will rebound to the same height every time and the second will not bounce at all.
4. The teacher will explain that energy cannot be created or destroyed, but only changed from one form into another. The kinetic energy lost with each bounce does not disappear. It is mostly converted into heat energy within the ball and bounce surface while some energy is converted to sound (which we used to collect our data.)
5. The teacher will point out that mathematical statements can be used to describe how one quantity changes when another changes. The formula used to calculate coefficient of restitution can be used to show how the value of the numerator (second bounce time) affects the value of ϵ . Point out that this value cannot exceed the value of the denominator. The second bounce of a ball will never be higher than the first unless energy is added to the system. Such an occurrence would give us a coefficient higher than 1.0.

- 6 The teacher will explain that instruments can be used to gather data for many purposes. Students will brainstorm and share examples of data collected and how it may be used.
- 7 The teacher will explain that data instruments can collect physical data such as time, mass, and a tally of events but it can also collect opinions and perceptions of people regarding a number of topics.
- 8 The teacher will show examples of survey questions and discuss how the quality of information compiled can vary in usefulness and accuracy. People may not recall information accurately, they may lie, the questions may be “the wrong questions” or be worded poorly, or the wrong sample of people may be surveyed.
- 9 The teacher will review the following concepts related to the impacts of technology.
 - a. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology’s development and use.
 - b. Decisions to develop technologies often put environmental and economic concerns in direct competition with one another.
 - c. Computers have become invaluable in science 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.
 - d. Energy cannot be created or destroyed, but only changed from one form into another.
 - e. Mathematical statements can be used to describe how one quantity changes when another changes.

Extension

1. Students will work in groups to create a survey that can be used to determine the answer to this question: How has cell phone use changed among adults (or students) in my community over the past year? Questions regarding when, where, how long, and for what purpose the phone was used should be included. Data will be presented in both graphical and narrative form. Conclusions based on the data should also be expressed.
2. The teacher will review the steps to be carried out in the extension activity by presenting the rubric for the technological design process with special attention to the criteria for each phase of the problem-solving process.
3. The teacher will inform students that periodic progress reports will be made by each team that will involve a brief presentation of their work.

Evaluation

Students’ knowledge, skills, and attitudes will be assessed using selected response items and rubrics for class participation, brief constructed responses, and for the oral presentation. The rubrics will be presented in advance of the activities to familiarize students with the expectations and performance criteria. They will also be reviewed during the activities to guide students in the completion of assignments. The teacher may wish to develop a collection of annotated exemplars of student work based on the rubrics. The exemplars will serve as benchmarks for future assessments and may be used to familiarize students with the criteria for assessment.

Laboratory-Classroom Preparation

The laboratory should provide a flexible, resource-rich, learning environment that includes areas for lecture and demonstrations, small group meetings, and research activities. The teacher will adapt the

learning environment based on the requirements of the unit or lesson. For this lesson, areas for lecture and demonstration, design, small group meetings, and fabrication activities should be readied.

Tools/Materials/Equipment

- Computers with audio inputs, microphone, and recording software
- Graph paper
- Calculators

Laboratory-Classroom Safety and Conduct

1. Students will use tools and equipment in a safe manner and assume responsibility for their safety as well as for the safety of others.
2. Students will demonstrate courtesy in regard to the ideas expressed by classmates and will show appreciation for the efforts of others.

Assessment Instrument - Selected Response Item

Directions: Circle the T or F in the column to the left of each true (T) or false (F) statement.

- | | | |
|---|---|--|
| T | F | 1. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology’s development and use. |
| T | F | 2. Decisions to develop technologies never put environmental and economic concerns in direct competition with one another. |
| T | F | 3. Computers have become invaluable in science 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. |
| T | F | 4. Energy can be either created or destroyed. |
| T | F | 5. Mathematical statements can be used to describe how one quantity changes when another changes. |

Assessment Instrument – Brief Constructed Response Item

Write a one-paragraph answer. Include a strong topic sentence with good supporting details to support your answer

Explain that technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology’s development and use.

Category	Below Target	At Target	Above Target
Understanding	Response demonstrates an implied, partial, or superficial understanding of the text and/or the question	Response demonstrates an understanding of the text and/or the question	Response demonstrates an understanding of the complexities of the text and/or the question
Focus	Lacks transitional information to show the relationship of the support to the question	Addresses the demands of the question	Exceeds the demands of the question
Use of Related Information	Uses minimal information from lectures, discussions, or texts to clarify or extend meaning	Uses some expressed or implied information from lectures, discussions, or texts to clarify or extend meaning	Effectively uses expressed or implied information from lectures, discussions, or texts to clarify or extend meaning

Assessment Instrument – Class Participation

Category	Below Target	At Target	Above Target
Preparation	Rarely prepared Minimal effort to participate	Prepared for class, attempts to answer teacher generated questions	Well prepared for class, attempts to answer teacher generated questions and adds additional information to class when relevant
Curiosity	Rarely demonstrates curiosity	Usually demonstrates curiosity	Consistently demonstrates curiosity
Motivation For Learning	Rarely demonstrates motivation for learning	Usually demonstrates motivation for learning	Consistently demonstrates motivation for learning
Use of Time	Gives up easily, is not engaged Has difficulty remaining on task	Makes good use of class time to work on assignments and projects	Makes excellent use of class time to work on assignments and projects

Assessment Instrument – Oral Presentation

Category	Below Target	At Target	Above Target
Organization	Audience has difficulty following presentation because student jumps around.	Student presents information in logical sequence which audience can follow.	Student presents information in logical, interesting sequence which audience can follow.
Subject Knowledge	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student is at ease with expected answers to all questions, but fails to elaborate.	Student demonstrates full knowledge (more than required) by answering all class questions with explanations and elaboration.
Graphics	Student occasionally uses graphics that rarely support text and presentation.	Student's graphics relate to text and presentation.	Student's graphics explain and reinforce screen text and presentation.
Mechanics	Presentation has three or more misspellings and/or grammatical errors.	Presentation has no more than two misspellings and/or grammatical errors.	Presentation has no misspellings or grammatical errors.
Eye Contact	Student occasionally uses eye contact, but still reads most of report.	Student maintains eye contact most of the time but frequently returns to notes.	Student maintains eye contact with audience, seldom returning to notes.
Elocution	Student's voice is low. Student incorrectly pronounces terms. Audience members have difficulty hearing presentation.	Student's voice is clear. Student pronounces most words correctly. Most audience members can hear presentation.	Student uses a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.

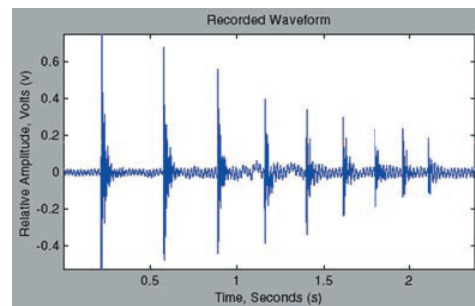
Student Resource 2.2.1 - Alive and Bouncing: Coefficient of Restitution Activity

Purpose: To collect data and draw conclusions concerning the “liveliness” of a bouncing ball.

An old tennis ball is often described as “dead” if it no longer bounces well. A basketball also has a desired “liveliness” that can be adjusted with air pressure. Both kinds of balls can be informally tested by simply dropping them and seeing how high they bounce. An experienced player or referee can determine if the ball is close to regulation. The coefficient of restitution is a scientific measure of a ball’s “liveliness”. Follow the procedure below to determine this scientific value.

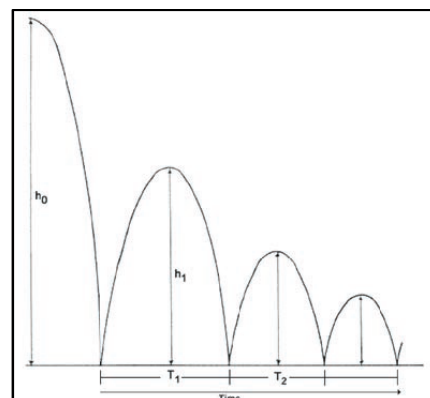
Each pair of students will need:

- 1 super ball
- 1 new tennis ball
- 1 meter stick
- 1 computer with microphone and audio recording software
- Solid floor or table surface



Procedure

1. Set up the computer and microphone near the bounce surface and record a test bounce of each ball to ensure that the sound is clearly “seen” on the recording meter.
2. Hold the tennis ball exactly one meter above the bounce surface and start the audio recorder.
3. Drop the ball and allow it to bounce five times and stop the recorder.
4. Record the time lapse between each of the bounces in the table below. This is the time (in seconds) between each bounce.
5. Repeat this process two more times for the tennis ball and three times for the rubber ball.
6. Return your materials to the teacher and complete the calculations and questions below.



Data

Tennis Ball	Time between 1 st and 2 nd bounce. (T ₁)	Time between 2 nd and 3 rd bounce. (T ₂)	Time between 3 rd and 4 th bounce. (T ₃)	Time between 4 th and 5 th bounce. (T ₄)
Trial 1				
Trial 2				
Trial 3				
Average Time (T _{ave})				

Rubber Ball	Time between 1 st and 2 nd bounce. (T ₁)	Time between 2 nd and 3 rd bounce. (T ₂)	Time between 3 rd and 4 th bounce. (T ₃)	Time between 4 th and 5 th bounce. (T ₄)
Trial 1				
Trial 2				
Trial 3				
Average Time (T _{ave})				

Calculations

The coefficient for restitution is express as Time₁ divided by Time₂.

“ε” is the measure of the “time loss” from each successive bounce.

this value for each pair of bounces and then find the average coefficient ε.

$$\epsilon = \frac{T_2}{T_1}$$

Calculate

Tennis ball	ε	ε	ε	Average ε
Use average times	T ₁ / T ₂ =	T ₂ / T ₃ =	T ₃ / T ₄ =	

Rubber ball	ε	ε	ε	Average ε
Use average times	T ₁ / T ₂ =	T ₂ / T ₃ =	T ₃ / T ₄ =	

Analysis

1. Describe how the time interval changed between each successive bounce.
2. How did the times differ between the tennis ball and the rubber ball?
3. The coefficient of restitution for a bouncing ball ranges from zero to one. Based on our information, does a coefficient value of one represent a perfectly “live” or “dead” ball. Explain your reasoning.

Unit 2 Lesson 3

Trends and Consequences of Technology System Use and Development

Lesson 3 Big Idea - Data can be collected and analyzed in order to identify positive and negative impacts of a technology.

Lesson Duration - Five (5) hours

Standards

- Students will develop an understanding of the cultural, social, economic, and political effects of technology. (ITEA Standards for Technological Literacy – Standard 4)
- Students will develop an understanding of the effects of technology on the environment. (ITEA Standards for Technological Literacy – Standard 5)
- Students will develop abilities to assess the impact of products and systems. (ITEA Standards for Technological Literacy – Standard 13)
- The Nature of Technology (AAAS Benchmarks for Science Literacy, Chapter 3)
- Problem Solving Standard Grade 6-8 (NCTM - Principles and Standards for School Mathematics)

Unit 2 – Impacts of Technology Systems

Big Idea – Information about the performance of technology systems can be collected and analyzed in order to identify positive and negative impacts.

Benchmarks

ITEA – Benchmarks for Technological Literacy

- The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. (STL 4D)
- Decisions to develop technologies often put environmental and economic concerns in direct competition with one another. (STL-5F)
- Design and use instruments to gather data. (STL – 13F)
- Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology. (STL – 13G)
- Identify trends and monitor potential consequences of technological development. (13-H)
- Interpret and evaluate the accuracy of information and determine if it is useful. (STL – 13I)

AAAS-Benchmarks for Science Literacy

- Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters entirely in favor of one side or another. That is because the contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be. (STL/ITEA 3C)

NCTM-Standards for School Mathematics

- Apply and adapt a variety of appropriate strategies to solve problems. (Problem Solving Grade 6-8, NCTM)

Learning Objectives - Students will learn to:

1. Identify positive and negative impacts of selected technologies.
2. Identify types of data useful in assessing the other impacts of this technology system.

3. Explain that technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.
4. Cite an instance where decisions to develop technologies put environmental and economic concerns in direct competition with one another.
5. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology.
6. Identify trends and monitor potential consequences of technological development.
7. Interpret and evaluate the accuracy of information and determine if it is useful.
8. Apply and adapt a variety of appropriate mathematics strategies to solve problems.
9. Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task.

Student Assessment Tools and/or Methods

(See assessment instruments at end of lesson)

1. Selected Response Items
2. Brief Constructed Response Items
3. Performance Rubrics

Resource Materials:

- **Print-Based Sources**

2. *Design and Problem Solving in Technology* by John Hutchinson, Glencoe/McGraw-Hill (1993)
ISBN-10: 0827352441 ISBN-13: 978-0827352445
3. *Introduction to Technology* by Alan Pierce and Dennis Karwatka, Glencoe/McGraw-Hill (1999)
ISBN0-02-831275-9

- **Internet Sites**

1. Traffic Safety Facts: Driver Cell Phone Use in 2005 – Overall Results <http://www-nrd.nhtsa.dot.gov/Pubs/809967.PDF>

Purpose of Lesson: To collect and use data to analyze the positive and negative impacts of a technology system.

5-E Lesson Plan

Engagement

1. The teacher will ask students to complete a chart listing what they feel are the positive and negative effects of a widely used technology system: Commercial Passenger Airplanes (See Teacher Resource 2.3.1)
2. The teacher will solicit ideas from the class and record several on the board leaving room to add information about each idea. Four positives and negatives will be sufficient. (Examples: saves travel time, safer than automobile travel, allows more people to see more places, provides many jobs, expensive, delays caused by congestion and weather, doesn't go everywhere, noise pollution, air pollution, consumes a lot of fuel,)
3. The teacher will ask students how they know these are the effects of using this transportation system.
4. The teacher will lead a discussion that guides students to the realization that data is needed to substantiate the existence and the degree to which the technology system is affecting our world.

5. The teacher will provide the following example:
6. Example: A negative affect may be identified as noise pollution. What data could we look at to see if it is having any affect on people or the environment? Home values near airports, decibel measurements at various points around the airport and on the plane, public survey concerning noise pollution. Some data may be more valuable in determining impacts than others.

Exploration

1. The teacher will assess overall understanding of identifying useful data by discussing another of the stated impacts and recording ideas on the board.
2. The students will work in small groups to identify types of data that would be useful in assessing the other impacts of this technology system.
3. The students will identify the value of having both current and historical data for the purpose of identifying trends. The data could show the significance of the perceived impact and if it has changed in magnitude over time.
4. The students will identify possible impacts of a technology system and methods for data collection that could be used to verify trends. Sample topics: video game systems, Internet, car air bags, digital cameras, SUV's.

Explanation

1. The teacher will revisit cell phone data collected in lesson 2 and evaluate its usefulness. Identify what information would be useful in assessing trend in cell phone use and its possible impacts on traffic safety.
2. Students will share their best examples of useful information that could be collected and what methods could be used.
3. The teacher will explain that:
 - a. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.
 - b. Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters entirely in favor of one side or another. That is because the contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be.
 - c. New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.
4. The teacher will present students with data from a report by the United States Department of Transportation titled *Driver Cell Phone Use in 2005*.

Extension

1. The teacher will assign students, working in groups of two, to research a trend in technology. (See Teacher Resource 2.3.2)
2. Students will conduct some preliminary research to identify a trend in technology.
3. The teacher will discuss possible topics including:
 - a. Nanotechnology -- Nanotechnology is already quietly revolutionizing a wide range of products -- from computer hard drives and sun block cream to car tires -- and will soon become a cornerstone of every manufacturing industry. The world's largest companies

- will increasingly drive advances and nanotech companies will generate substantial revenue for the very first time. Potential uses will include using nano-spheres to deliver a drug directly to its intended target; employing nano-scale manufacturing processes to make smaller and faster processors and storage devices; and using nano-scale properties to make stain resistant, crease-free fabrics, and garments that resist bacteria.
- b. Electronic viruses -- Massive growth in connected technologies -- from PCs and mobile phones to PDAs and gaming consoles -- will cause a corresponding leap in electronic viruses and other malicious attacks. Nuisances such as unsolicited e-mail (SPAM) and unsolicited instant messages (SPIM) will continue to proliferate. More harmful intrusions, such as viruses, worms and malware (malicious software), blue-jacking (attacks on Bluetooth-enabled devices) and VoIP SPAM will become common, and increased use of mobile phones, remote working and WiFi will give hackers more access to private, corporate and government networks. The trend will cost businesses worldwide billions of dollars in lost data and downtime; at the same time, it will reveal vast opportunities for companies that sell IT security, and new lines of business will spring up from mobile operators, handset makers, service providers, and systems integrators.
 - c. Electronic identification vs. Digital crime. Governments around the world will move to replace paper-based IDs with digital products. These new forms of electronic identification will be used in passports, ID cards, bank cards and credit cards, and will include information such as the individual's name, address, nationality, digital photo and even biometric data. Electronic identification will be principally designed to curb fraud and identity theft, but will also speed up the process of identification and authentication. In spite of these measures, identity theft will continue to rise dramatically - particularly for people and organizations that do business online. It will be imperative for all companies doing business online to spend the money to create more secure methodologies to protect themselves and their customers.
 - d. Robots will move into our homes to help us with household chores and other mundane tasks.
 - e. Space exploration will shift toward the private sector.
 - f. Wireless 'mesh' networks will appear, helping authorities in major cities track the status of equipment and assets over a wide area.
 - g. Quantum computers, which will be exponentially faster than today's fastest supercomputers, will take a few important steps closer to reality.
4. The student groups will develop a one-page information sheet that describes the trend and analyzes the technology (Potential positive and negative impacts)
 5. The teacher will review the criteria for this activity using the Information Sheet Rubric provided in the Lesson Assessment Instruments section of this lesson.
 6. The teacher will demonstrate layout skills to be applied in the development of the one-page information sheet. The teams' information sheets may be displayed or duplicated for inclusion in students' portfolio.

Evaluation: Students knowledge, skills, and attitudes will be assessed using selected response items and rubrics for class participation, brief constructed responses, and for the oral presentation. The rubrics will be presented in advance of the activities to familiarize students with the expectations and performance criteria. They will also be reviewed during the activities to guide students in the completion of assignments. The teacher may wish to develop a collection of annotated exemplars of

student work based on the rubrics. The exemplars will serve as benchmarks for future assessments and may be used to familiarize students with the criteria for assessment.

Laboratory-Classroom Preparation

The laboratory should provide a flexible, resource-rich, learning environment that includes areas for lecture and demonstrations, small group meetings, and research activities. The teacher will adapt the learning environment based on the requirements of the unit or lesson. For this lesson, areas for lecture and demonstration, design, small group meetings, and fabrication activities should be readied.

Tools/Materials/Equipment:

- Computers with Internet access
- Reference books
- Calculators

Laboratory-Classroom Safety and Conduct

1. Students will use tools and equipment in a safe manner and assume responsibility for their safety as well as for the safety of others.
2. Students will demonstrate courtesy in regard to the ideas expressed by classmates and will show appreciation for the efforts of others.

Assessment Instrument - Selected Response Item

Directions: Circle the T or F in the column to the left of each true (T) or false (F) statement.

- | | | |
|---|---|---|
| T | F | 1. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. |
| T | F | 2. Technology issues are usually uncomplicated and easy to resolve. |
| T | F | 3. Relevant facts alone, even when known and available, usually do not settle matters entirely in favor of one side or another. |
| T | F | 4. New technologies increase some risks and decrease others |
| T | F | 5. New technologies have improved the length and quality of life for many people without adding new risks. |

Assessment Instrument – Brief Constructed Response Item

Write a one-paragraph answer. Include a strong topic sentence with good supporting details to support your answer

Describe an instance where decisions to develop technologies put environmental and economic concerns in direct competition with one another.

Category	Below Target	At Target	Above Target
Understanding	Response demonstrates an implied, partial, or superficial understanding of the text and/or the question	Response demonstrates an understanding of the text and/or the question	Response demonstrates an understanding of the complexities of the text and/or the question
Focus	Lacks transitional information to show the	Addresses the demands of the question	Exceeds the demands of the question

	relationship of the support to the question		
Use of Related Information	Uses minimal information from lectures, discussions, or texts to clarify or extend meaning	Uses some expressed or implied information from lectures, discussions, or texts to clarify or extend meaning	Effectively uses expressed or implied information from lectures, discussions, or texts to clarify or extend meaning

Assessment Instrument– One-Page Information Sheet

	Below Target	At Target	Above Target
Title	Title missing or difficult to locate	Title is effective and accurately describes the material. Title is easy to locate	Title is effective and accurately describes the material. Title is easy to locate
Content Facts	Information is often inaccurate or incomplete	Information is accurate and complete	Information accurate and exceeds the demand of the assignment
Graphics or Pictures	Several graphics are not effective	All graphics are effective	All graphics are effective and balanced with text use
Style & Organization	Lacks a visual focal point. Space is unevenly used Messy and uneven	Title or graphic forms a focal point. Facts and graphics are distributed well. Text and graphics are neat and even.	Title and graphics form a focal point. Facts and graphics are distributed well. Text and graphics are exceptionally neat and even.
Documentation	Sources not properly documented, too few, or inappropriate	Two properly documented sources	More than two properly documented sources
Subject Knowledge	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student is at ease with expected answers to all questions, but fails to elaborate.	Student demonstrates full knowledge (more than required) by answering all class questions with explanations and elaboration.

Assessment Instrument – Class Participation

Category	Below Target	At Target	Above Target
Preparation	Rarely prepared Minimal effort to participate	Prepared for class, attempts to answer teacher generated questions	Well prepared for class, attempts to answer teacher generated questions and adds additional information to class when relevant
Curiosity	Rarely demonstrates curiosity	Usually demonstrates curiosity	Consistently demonstrates curiosity
Motivation For Learning	Rarely demonstrates motivation for learning	Usually demonstrates motivation for learning	Consistently demonstrates motivation for learning
Use of Time	Gives up easily, is not engaged Has difficulty remaining on task	Makes good use of class time to work on assignments and projects	Makes excellent use of class time to work on assignments and projects

Technology Systems
A Standards-Based Middle School Model Course Guide

Teacher Resource 2.3.1

Impacts of Technology Commercial Passenger Airlines	
Positive	Negative
<i>Saves travel time</i>	<i>Expensive</i>
<i>Safer than automobile travel</i>	<i>Delays caused by congestion and weather</i>
<i>Allows more people to see more places</i>	<i>Doesn't go everywhere</i>
<i>Provides many jobs</i>	<i>Noise pollution, air pollution</i>
<i>Supports business activities</i>	<i>Consumes a lot of fuel</i>

Teacher Resource 2.3.2

Trends in Technology Information Sheet

Nanotechnology

At the very heart of nanotechnology and its future promise are the tools, instruments, metrological devices, and modeling/simulation applications that will enable us to effectively position matter and build intricate structures with atomically precise control. Many novel instruments have been created and today they are accelerating the pace of developing innovative top-down and bottom-up manufacturing processes. Soon they will enable us to fabricate materials, components, devices, and products on a more cost-effective, highly repeatable, and replicable basis.

Nanotechnology is already quietly revolutionizing a wide range of products -- from computer hard drives and sun block cream to car tires -- and will soon become a cornerstone of every manufacturing industry. The world's largest companies will increasingly drive advances and nanotech companies will generate substantial revenue for the very first time.

Potential Impacts of Technology Nanotechnology	
Positive	Negative
Building a food supply in a box-sized factory, assembling lunch molecule by molecule	The power of the technology may cause two competing nations to enter a disruptive and unstable arms race.
Creating robots so tiny it could be sent into the human blood stream to "fix" diseases like cancer.	Weapons and surveillance devices could be made small, cheap, powerful, and very numerous.
Translating electronic data into atomic arrangements on a special medium, so that a single square centimeter of the medium could contain 10 gigabytes of data.	Cheap manufacturing and duplication of designs could lead to economic upheaval.
Goods manufactured in a "black box" with an assembler that arranges the individual atoms and molecules of the raw materials, lining them up until the desired product results.	Overuse of inexpensive products could cause widespread environmental damage.
Clean, cheap production that could produce the tiniest ever computer processors, or food for the entire planet.	Attempts to control these and other risks may lead to abusive restrictions, or create demand for a black market that would be very risky and almost impossible to stop; small nanofactories will be very easy to smuggle, and fully dangerous.

