Emerging Technologies

Unit: Technology

Problem Area: Adapt to Changing Technology

Lesson: Emerging Technologies

Student Learning Objectives.

Instruction in this lesson should result in students achieving the following objectives:

1. **Explain important issues related to sources of emerging technology.**
2. **Identify the process for emerging technologies.**
3. **Describe examples of emerging technology.**

Resources.

The following resources may be useful in teaching this lesson:

Bustillo, Miguel. "Wal-Mart Radio Tags to Track Clothing," *The Wall Street Journal*. Accessed Nov. 2, 2011. <http://online.wsj.com/article/SB10001424052748704421304575383213061198090.html>.

Grow, Roger. "How Does RFID Work?" *eHow*™. Accessed Nov. 2, 2011. <http://www.ehow.com/video_4774382_rfid-work_.html>.

"Square Plans to Replace Cash Registers and Wallets," *TNW Insider*. Accessed Nov. 2, 2011. <http://thenextweb.com/insider/2011/05/23/square-plans-to-replace-cash-registers-and-wallets/>.

Thierer, Adam D. "Regulating Video Games: Must Government Mind Our Children?" *CATO Institute*. Accessed Nov. 2, 2011. <http://www.cato.org/pub_display.php?pub_id=11521>.

"Who Owns the Internet?" *Howstuffworks*. Accessed Nov. 2, 2011. <http://computer.howstuffworks.com/internet/basics/who-owns-internet.htm>.

Equipment, Tools, Supplies, and Facilities

- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials

Key Terms.

The following terms are presented in this lesson (shown in bold italics):

- adaptation
- bench scale testing
- field study
- identification
- private
- production
- proprietary
- public

Interest Approach.

Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Solicit student opinion with the following question: "Should new video games have regulations restricting violence, or should the makers of these games be free to use whatever violent content they want?" Use the discussion to broach the topic of public and private roles related to emerging technology.*

CONTENT SUMMARY AND TEACHING STRATEGIES

Objective 1: Explain important issues related to sources of emerging technology.

Anticipated Problem: What are the important issues related to sources of emerging technology?

I. Sources of technology are traceable to two paths: public and private development.

A. Emerging technology originates in public and private sectors. ***Proprietary*** is technology owned by a company and protected by property rights law; the owner is

free to profit using the technology as an asset in a competitive environment. Proprietary is a conceptual dividing line between public and private sources of technology.

1. ***Public*** is a term used to describe non-profits and governmental agencies that create technology with the intention of helping the greater societal good (and not focusing on making a profit).
    a. For example, creation of the Internet came from President Dwight D. Eisenhower's Advanced Research Projects Agency (ARPA) in 1958 and is an example of public research focusing on improving computer power and networking communications in response to the Soviet Union's launching of Sputnik.
    b. The Internet was created by the government to improve the United States' competitive global position in technology development. However, the Internet is not "owned" as a proprietary technology by one company.
2. ***Private*** is a term used to describe for-profit businesses that create proprietary technology. While no one person or company owns the Internet, Internet service providers (e.g., Comcast™ and AT&T™) own hardware and software that connect people to the Internet and help with using it.
    a. Smartphones and applications are proprietary technology offered by private companies.
    b. The Internet is a technology with no owner, originating from the public sector.
    c. Technology tools for using the Internet are "owned" and generate profits for private sector companies.

B. There is an ideological debate around the creation of emerging technology. In this debate, private and public sectors take on different roles regarding emerging technology.
    1. Public-side advocates believe the free market and private sector do not always take into consideration what is best for the public good. Public-side advocates believe some regulation is needed (e.g., in the areas of ethics) when it comes to emerging technology.
    2. Private-side advocates believe the free market, profit, receiving recognition and status, and capitalist principles are the best entrepreneurial motivators for emerging technology. This side believes the public sector, because of its bureaucratic nature, lacks the necessary motivation and skills to create more innovative technologies.
    3. An example of compromise between public and private sector roles with emerging technology is in the video game industry. The industry is under pressure to create a rating system to protect younger viewers from exposure to inappropriate content.
        a. Public-advocates take the position that restricting the violent content of these video game technologies helps with the greater social good.
        b. Private-advocates believe that video game content should not be censured. They would prefer to appease public-advocate concerns by using a self-

imposed rating system rather than having the government meddling with a rating system.

c. In the United States, there is no formal regulation of what content can go into emerging video game technology, but there is recognition that a rating system is necessary. This reflects a compromise between the private and public sector roles with respect to emerging technologies.

d. Many other examples can be discussed with students: the ethical debate around stem-cell research using an aborted fetus; the debate around genetic-mapping research that reveals individual inclinations toward developing future illnesses and the impact this information could have on providing health insurance; and privacy issues with consumer use of web-based digital information and communication technologies.

Teaching Strategy: *Use VM–A through VM–F. Have students read the information at http://www.cato.org/pub_display.php?pub_id=11521 and write a one-page opinion paper answering the following questions: "Which sector does this article seem to favor: private or public? Which points do you agree or disagree with in the article and why?"*

Then have students visit http://computer.howstuffworks.com/internet/basics/who-owns-internet.htm and discuss the most interesting thing they learned there as well as one area they would like to learn more about.

Objective 2: Identify the process for emerging technologies.

Anticipated Problem: What is the process for emerging technologies?

II. Emerging technology generally follows these steps: identification, bench scale testing, field study, production, and adaptation.

A. ***Identification*** is the process for discovering new ideas for technology. For instance, Microsoft™ identifies new technology ideas from innovative employees and user surveys for developing the next windows operating systems.

B. ***Bench scale testing*** is the process for testing a new technology in a small laboratory-oriented setting to see if the technology does what it is meant to do. For example, New Microsoft Windows™ operating systems are tested in the company laboratories during this phase.

C. ***Field study*** is the process of testing the new technology among a larger group in a "real-life" setting. For instance, Microsoft Windows™ operating system is tested in the field among a user group to find program bugs and glitches before the new technology goes to production.

D. ***Production*** is the mass creation of a new technology on a large scale for consumer use. For example, Microsoft Windows™ new operating systems would be burned onto millions of data disks as part of production.

E. ***Adaptation*** is the process of fixing glitches in the technology as they appear, after the production phase. For instance, Microsoft Windows™ new operating systems come with an automatic updating system that updates new software and fixes it as errors are discovered.

Teaching Strategy: *Use VM–G through VM–L to aid in a class discussion. Have students get into small groups to brainstorm a list of ideas for new computer technologies they would like to see developed.*

Objective 3: Describe examples of emerging technology.

Anticipated Problem: What are examples of emerging technology?

III. Emerging technologies, how they work, and their benefits

A. Revolutionizing the sales checkout process: Square™ technology

1. Supportive technology:
   a. Smartphones—iPhone™
   b. Tablet computer—iPad™
   c. Software applications—Square Card Case™ app. and Square Register™ app.
2. How it works
   a. The customer uses an iPhone™ and opens Square Card Case™. The Square Card Case application has a directory (a list of businesses using Square checkout registers); a menu (a list of products for sale at the business); tabs (lists of payment options); and receipts (generates reports and receipts showing a history of purchases at that business).
   b. The customer taps the business button from the directory and selects products from the menu.
   c. The business taps Square Register™ on an iPad™ button that communicates with the customer's iPhone application and learns the order.
   d. The customer's iPhone interacts with the business iPad, and the payment method is completed online.
   e. A digital receipt is given to the customer. There is no physical interaction (receipt) exchanged between the business and the customer.
3. Benefits to businesses and individuals
   a. There are no consumable business costs (e.g., receipt paper for the register).
   b. There is less of a chance for inadequate funds, such as bounced checks.
   c. It is environmentally friendly because all records are digital.
   d. It is more convenient and requires less space. There is no more need for a wallet or a cash register, just a few taps on a phone and a tablet computer.

e. It helps with public health issues. For example, it minimizes the passing of germs and colds because there is no physical contact with others.

B. Revolutionizing supply chaining and inventory management: radio frequency identification (RFID)
   1. Supportive technology
      a. Radio frequency identification tags
      b. Scanners
   2. How it works
      a. Wal-Mart™, as an example, uses RFID in its supply chain and in its 3,750+ stores throughout the United States.
      b. For central warehouse and supply chain use, Wal-Mart requires suppliers to tag merchandise with radio frequency identification tags that emit a radio wave detectable with the use of a scanner. RFID is used on bulk pallet deliveries in the central warehouse to track incoming and outgoing merchandise as it travels along conveyor belts.
      c. For individual store use, RFID tags are being placed on individual items (e.g., jeans and undergarments). Employees are able to scan these items for various purposes (e.g., searching the rack for sizes).
   3. Benefits to businesses and individuals
      a. It is easier to track inventory during the supply chain travel of merchandise from the supplier to Wal-Mart corporate to the store.
      b. It involves easier inventory tracking on the shelves at stores. Employees will know what sizes are missing from the shelf and will be able to complete storewide inventory scans much quicker.
   4. Privacy rights
      a. Advocates for consumer rights point out that customers wearing clothes with RFID tags are traceable. For example, if someone wore underwear purchased at Wal-Mart with an RFID tag that was never removed, then potentially Wal-Mart could track the whereabouts of the customer by secretively scanning the customer's underwear. Wal-Mart has asked suppliers to place RFID on packaging and not directly on the actual article of clothing to prevent this situation.
      b. Advocates for consumer rights indicate that if customers have other RFID tags (contained on employee identification or personal identification cards), then store personnel could scan customers and obtain personal information. This could lead to the misuse of personal information.

Teaching Strategy: *Use VM–M through VM–Q to lecture on content from this objective. Haves students read more about Square technology at http://thenextweb.com/insider/2011/05/23/square-plans-to-replace-cash-registers-and-wallets/. In addition, have students read more about RFID technology at http://www.ehow.com/video_4774382_rfid-work_.html and http://online.wsj.com/article/SB10001424052748704421304575383213061198090.html.*

Review/Summary.

Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at the ends of chapters in the textbook may also be used in the Review/Summary.

Application.

Use the included visual master(s) and lab sheet(s) to apply the information presented in the lesson.

Evaluation.

Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

Answers to Sample Test:

Part One: Matching

1. g
2. e
3. h
4. d
5. b
6. c
7. f
8. a

Part Two: Completion

1. government
2. private
3. online
4. regulation
5. production
6. identifies

Part Three: True/False

1. T
2. F
3. T
4. T
5. F
6. T

Sample Test

Name _____

Emerging Technologies

Part One: Matching

Instructions: **Match the term with the correct definition.**

a. adaptation
b. bench scale testing
c. field study
d. identification
e. private
f. production
g. proprietary
h. public

_____1. Technology owned by a company and protected by property rights law; the owner is free to profit using the technology as an asset in a competitive environment

_____2. A term used to describe for-profit businesses that create proprietary technology

_____3. A term used to describe non-profits and governmental agencies that create technology with the intention of helping the greater societal good

_____4. The process for discovering new ideas for technology

_____5. The process for testing a new technology in a small laboratory-oriented setting to see if the technology does what it is meant to do

_____6. The process of testing the new technology among a larger group in a "real-life" setting

_____7. The mass creation of a new technology on a large scale for consumer use

_____8. The process of fixing glitches in the technology as they appear, after the production phase

Part Two: Completion

Instructions: **Provide the word or words to complete the following statements.**

1. The Internet was created by the _____ to improve the United States' competitive global position in technology development.

2. Technology tools for using the Internet are "owned" and generate profits for _____ sector companies.

3. Money exchange using Square ™ technology happens _____ and is an example of contactless sales.

4. In the United States, there is no formal _____ of what content can go into emerging video game technology, but there is recognition that a rating system is necessary.

5. Microsoft Windows™ new operating systems would be burned onto millions of data disks as part of _____.

6. Microsoft™ _____ new technology ideas from innovative employees and user surveys for developing the next windows operating systems.

Part Three: True/False

Instructions: **Write *T* for true or *F* for false.**

_____1. Creation of the Internet came from President Dwight D. Eisenhower's Advanced Research Projects Agency (ARPA) in 1958.

_____2. The Internet itself is "owned" as a proprietary technology by one company.

_____3. Smartphones and applications are proprietary technology offered by private companies.

_____4. Public-side advocates believe some regulation is needed (e.g., in the areas of ethics) when it comes to emerging technology.

_____5. The process for emerging technologies is bench study, identification, field study, production, and adaptation.

_____6. People are concerned that RIFD tags may breach on personal safety and privacy.

PUBLIC AND PRIVATE SECTORS

Proprietary is the technology owned by a company and protected by property rights law; the owner is free to profit using the technology as an asset in a competitive environment. Proprietary is a conceptual dividing line between public and private sources of technology.

- **Public** is a term used to describe non-profits and governmental agencies that create technology with the intention of helping the greater societal good (and not focusing on making a profit).
- **Private** is a term used to describe for-profit businesses that create proprietary technology.

EXAMPLE OF PUBLIC SECTOR TECHNOLOGY EMERGENCE

- Creation of the Internet came from President Dwight D. Eisenhower's Advanced Research Projects Agency (ARPA) in 1958 and is an example of public research focusing on improving computer power and networking communications in response to the Soviet Union's launching of Sputnik.
- The Internet was created by the government to improve the United States' competitive global position in technology development.
- The Internet is not "owned" as a proprietary technology by one company.

EXAMPLE OF PRIVATE SECTOR TECHNOLOGY EMERGENCE

While no one owns the Internet, Internet service providers (e.g., Comcast™ and AT&T™) own hardware and software that connect people to the Internet and help with using it.

- Smartphones and applications are proprietary technology offered by private companies.
- The Internet is a technology with no owner, originating from the public sector.
- Technology tools for using the Internet are "owned" and generate profits for private sector companies.

VM–D

THE DEBATE: PRIVATE-SIDE ADVOCATES

Private-side advocates believe the free market, profit, receiving recognition and status, and capitalist principles are the best entrepreneurial motivators for emerging technology. This side believes the public sector, because of its bureaucratic nature, lacks the necessary motivation and skills to create more innovative technologies.

VM–E

THE DEBATE: PUBLIC-SIDE ADVOCATES

Public-side advocates believe the free market and private sector do not always take into consideration what is best for the public good. Public-side advocates believe some regulation is needed (e.g., in the area of ethics) when it comes to emerging technology.

VM–F

EXAMPLE OF COMPROMISE WITHIN PRIVATE AND PUBLIC DEBATE

- The video game industry is under pressure to create a rating system to protect younger viewers from exposure to inappropriate content.
- Public-side advocates take the position that restricting the violent content of these video game technologies helps with the greater social good.
- Private-advocates believe video game content should not be censured. They would rather appease the public-advocate's concerns by using a self-imposed rating system rather than having the government meddling by creating a rating system.
- In the United States, there is no formal regulation of what content can go into emerging video game technology, but there is recognition that a rating system is necessary. This reflects a compromise between the private and public sector roles and how they affect emerging technologies.

THE PROCESS FOR EMERGING TECHNOLOGIES

1. Identification
2. Bench scale testing
3. Field study
4. Production
5. Adaptation

IDENTIFICATION

- **Identification** is the process for discovering new ideas for technology.
- For example, Microsoft™ identifies new technology ideas from innovative employees and user surveys for developing the next windows operating systems.

BENCH SCALE TESTING

- **Bench scale testing** is the process for testing a new technology in a small laboratory-oriented setting to see if the technology does what it is meant to do.
- For instance, New Microsoft Windows™ operating systems are tested in the company laboratories during this phase.

FIELD STUDY

- **Field Study** is the process of testing the new technology among a larger group in a "real-life" setting.
- For example, Microsoft Windows™ operating system is tested in the field among a user group to find program bugs and glitches before the new technology goes to production.

PRODUCTION

- **Production** is the mass creation of a new technology on a large scale for consumer use.
- For instance, Microsoft Windows™ new operating systems would be burned onto millions of data disks as part of production.

ADAPTATION

- **Adaptation** is fixing glitches in the technology as they appear, after the production phase.
- For example, Microsoft Windows™ new operating systems come with an automatic updating system that updates new software fixes as errors are discovered.

VM–M

REVOLUTIONIZING THE SALES CHECKOUT PROCESS: SQUARE™ TECHNOLOGY

Supportive Technology:

- iPhone™, iPad™, Square Card Case™ app. and Square Register™ app.

Benefits to Businesses and Individuals:

- There are no consumable business costs (e.g., receipt paper for the register).
- There is less of a chance for inadequate funds (e.g., bounced checks).
- It is environmentally friendly because all records are digital.
- It is more convenient and takes up less space. There is no more reason for a wallet or cash register, just a few taps on a phone and tablet computer.
- It helps with public health issues. For example, it minimizes the passing of germs and colds because there is no physical contact with others.

HOW SQUARE™ TECHNOLOGY WORKS

1. The customer uses iPhone™ and opens Square Card Case™. The Square Card Case application has the following:

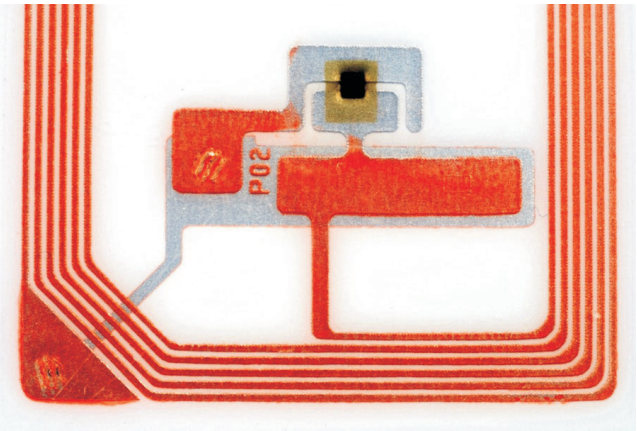
   - Directory (a list of businesses using Square checkout registers)
   - Menu (a list of products for sale at the business)
   - Tabs (lists payment options)
   - Receipts (generates reports and receipts showing history of purchases at that business)

2. The customer taps the business button from the directory and selects the products from the menu.
3. The business taps Square Register™ on an iPad™ button, which communicates with the customer's iPhone application and learns the order.
4. The customer's iPhone interacts with the business iPad, and the payment method is completed online.
5. A digital receipt is given to the customer. There is no physical interaction (e.g., a receipt) exchanged between the business and the customer.

REVOLUTIONIZING SUPPLY CHAINING AND INVENTORY MANAGEMENT: RADIO FREQUENCY IDENTIFICATION

Supportive Technology:

- Radio frequency identification tags and scanners



Benefits to Businesses and Individuals:

- It is easier to inventory the tracking during the supply chain travel of merchandise from the supplier to Wal-Mart corporate to the store.
- It is easier to inventory the tracking on the shelves at the stores. Employees will know what sizes are missing from the shelf and will be able to complete storewide inventory scans much quicker.

HOW RFID WORKS: WAL-MART™

- Wal-Mart™ uses RFID in its supply chain and in its 3,750+ stores throughout the United States.
- In central warehouse and supply chain use, Wal-Mart requires suppliers to tag merchandise with radio frequency identification tags that emit a radio wave detectable using a scanner. RFID is used on bulk pallet deliveries in the central warehouse to track incoming and outgoing merchandise as it travels along conveyor belts.
- For individual store use, RFID tags are being placed on individual items (e.g., jeans and undergarments). Employees are able to scan these items for various purposes, such as searching the rack for sizes.

CONCERNS: RFID AND PRIVACY RIGHTS

- Advocates for consumer rights point out that customers who wear clothes with RFID tags are traceable. For example, if people wear underwear purchased at Wal-Mart containing RFID tags that are never removed, then potentially Wal-Mart could track the whereabouts of the customers by secretively scanning their underwear. Wal-Mart has asked suppliers to place RFID on packaging and not directly on the actual articles of clothing to avoid potential privacy violations.
- Advocates for consumer rights point out that if customers have other RFID tags (contained on employee identification or personal identification cards), store personnel could scan customers and obtain personal information, which could lead to the misuse of the personal information.

LS–A

Name _____

Tracking Emerging Technology

Purpose

The purpose of this activity is to compile resources for monitoring emerging technology.

Objectives

1. Research resources for keeping track of emerging technology.
2. Compile a list of journals, websites, or organizations that monitor and report on emerging technology.

Materials

- lab sheet
- Internet-connected computer
- word processor
- paper
- writing utensil

Procedure

1. Work with two classmates to form a research team.
2. Using the "suggested search terms" list provided in this lab, along with your own search terms, complete an Internet search. Identify resources that monitor emerging technologies.
3. When your team identifies a resource, record the name of the website, journal, or organization and the web address. Record the right information so you are able to find the resource again. (You may want to bookmark the resource, if possible.)

4. Compile a list of five resources you find of websites, journals, or organizations that monitor and report on emerging technologies.
5. As you research, identify one technology item that you want to learn more about, and write that down.
6. Share and compile research results with the whole class. Form one master list that includes resources for monitoring emerging technology and a list of personal interest technology that each person noted during the research.

Suggested Search Terms

- "How to find emerging technology"
- "Emerging technologies"
- "New technologies"

Tracking Emerging Technology

The list of technologies of interest to students could be used to develop extension activities, such as doing further research on technology, exploring public vs. private ethical debates, or writing personal opinion papers on the technology's potential and/or ethical debates.