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The Cultural Impact of Computer Technology

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Some sociologists believe that technological innovation is the single most important source of social change. But just how does a technological advancement spur social change? What are some of the changes taking place due to the proliferation of technology in our society? In this curriculum unit we will survey some of the technological breakthroughs being made today while simultaneously exploring how these advancements are impacting our culture, our relationships and our individual lives. The content in this unit will challenge students to:

> a. understand the connection of the past to conditions today
> b. examine the relationship between innovation and the American living standard
> c. explore how the "information marketplace" has been a catalyst for change
> d. assess how the job market has evolved and will continue to evolve
> e. hypothesize on future trends and inventions in the twenty first century

Societies are constantly changing. Some of these changes are subtle and barely noticeable. Other changes are blatant and abrupt. Social changes can affect the values, norms, roles and institutions within a particular community. The Industrial Revolution for example, which began circa 1750, was a true revolution or radical change for English society. Studying the effects of the Industrial Revolution on English society can help us identify patterns or similarities with the changes taking place today.

INDUSTRIAL REVOLUTION

The Industrial Revolution was a period of dynamic change and dramatic innovation in the history of human society. During this period, which lasted from approximately 1750 to 1850, new methods were adopted which forever changed the means of producing goods. The development of factories, the introduction of mass production methods, the utilization of steel and the emergence of new forms of transportation and communication - all had a profound effect on where and how people lived, worked and interacted. The long term changes ushered in during this period still resonates today.

Of all the places in the world, why did the Industrial Revolution ignite in England. What domestic considerations permitted England to become the world's first industrial country? In his book, The Silent Revolution, author John Osborne warn us not to oversimplify any explanation for this historical occurrence(1). The author points to the fact that England had favorable advantages over its neighbors during the mid 1800s. First, England had a stable but not oppressive governmental system. Secondly, England benefited from a favorable geographical location. Lastly, the English had a relatively flexible class structure. Compared with other countries on the European continent England was economically and socially well off. In most of the other countries tradition smothered innovation (2).

The British drive toward economic supremacy involved creating new machines and experimenting with more efficient manufacturing techniques. The greater understanding of nature, a result of scientific discoveries of the preceding century, encouraged the development of a more critical attitude toward manufacturing techniques (3). In approximately fifty years the concept of "modern production was created". This development had immediate ramifications for the "worker" of the era. The domestic worker with his simple hand tools would gradually give way to a factory worker in charge of a complicated machine powered by steam. While these changes were taking place, a tradition of private investment in promising new enterprises was growing . Britains commercial tradition, operating against a backdrop of peace and comparative prosperity provided new ventures with the investment capital, raw materials and profits which propelled the country into the forefront of the Industrial Revolution.

The invention of the steam engine allowed new production techniques to be adopted. The technical success of these steam engines translated into greater productivity. Over a short span of time new production methods were adopted industry by industry. Technical know how changed the way business was conducted and altered the relationships involved. For one thing, industries utilized materials and resources which were formerly either ignored, too expensive or used locally only. Advancements in tooling and production caused a flood of quality products which dramatically upgraded the quality of peoples lives. China clays for example, which were formed into fine pottery by craftsman could now be made available to the rich as well as the poor. The availability of inexpensive dishes had a positive effect on peoples' health, for it could be cleaned more efficiently than the pewter previously used by the poor. Cheaply produced sulphuric acid was used in making cotton goods, soap and glass (4). Manufacturing this acid cheaply significantly lowered the price of these commodities in the marketplace. The use of gas for lighting was in itself a minor social revolution (5). Thanks to gas, the streets of London were made brighter and safer than before. As a result of these changes the insurance premiums for many buildings in London were reduced.

Producing more goods more efficiently was one matter; getting these finished goods to market over a decrepit road system was another challenge. The markets opened up by increased production demanded a revitalized infrastructure and a dependable transportation network in Britain. To achieve this goal the first

thing done was reformation of the bureaucratic system of funding and maintaining roads. Inspired by the spirit of innovation let loose during this era, engineers applied new road building methods and experimented with new materials. The results of the improvement were often spectacular. Travel time from London to Birmingham in the 1740's was two days; in the 1780s it was reduced to only nineteen hours (6). Better roads opened a new world of possibilities for travelers during this era. A wider range of people could now travel through England. Road improvements also led to new jobs and new opportunities, such as the traveling salesman. Better roads fostered intellectual inquiry, reduced rural dullness as well as tempting ambitious country youth to try their luck in the city.

By the early nineteenth century superior stage coaches were attracting passengers who demanded and got more comfortable coaches and cleaner roadside inns. This system of long distance, horse drawn travel would flourish until the advancement of the "iron horse" in the 1830's made it obsolete.

Between 1780 and 1840 the population of the United Kingdom doubled. What created this phenomenal growth in the population of England? (7). Was it a higher birth rate, lower death rate or some combination of the two? Eighteenth century advances in medicine and sanitation, plus a more abundant food supply, were credited with lowering the rate of mortality, particularly among infants and children. By the early 1800's uncontrolled population growth was a major concern in England. It was assumed by economists that increasing population was a cause of poverty and that everything should be done to discourage early marriages. Initially, the poor were asked to abstain from marriage until they could afford it, but after 1830 they were increasingly urged to emulate the example of the virtuous middle class (8). A new force in society was emerging: the middle class. The middle class had grown in socioeconomic power and their conduct had become the moral imperative of the poor. In earlier periods the approved pattern in marriage had been set by the aristocracy, and it was a casual one (9). Now the middle class, proud of its rising standard of living, was anxious to make the poor sacrifice so they too could climb to bourgeoisie status.

The increased wealth and prosperity set in motion by the Industrial Revolution caused a shift in values for many people. Materialism gave new life, hope and new meaning to many poor people during this period. As a result, materialism took on new meaning and became a "new god". Mans' increasing self reliance and preoccupation with self also raised him to the status of "god". Scientific reason and knowledge became yet another "god" with its principal agents, the scientist and the technologist. Scientists and technologists were perceived as the "high priests" of technological advancement and many people had "faith" in their power to improve the world.

THE INFORMATION AGE

Since the dawn of the Industrial Revolution life in industrial and post industrial societies have been characterized by a constant stream of evolving products, innovative methods of production and dynamic means of distribution. The development of the world wide web, for example, is a major breakthrough in the advancement of communication. Today, a few years after its introduction, the Web has become a major cultural movement involving millions of people. One eminent computer scientist, Michael Dertouzos, head of the Massachusetts Institute of Technology Laboratory for Computer Science, has authored a captivating book about the future of computer science. Mr. Dertouzos thoughtfully explain his vision of the future "Information Marketplace". In What Will Be, the author gives the reader an insiders preview of the advancements and inventions that will propel the information revolution in new directions.

The world of information that we now live in has already altered many aspects of our lives, either directly or indirectly. For example, the millions of web users, from homeowners to Chief Executive Officers, have grown in numbers at an astronomical rate, adding daily to the cumulative web of information by posting their own "home pages" that describe their own specific interests and needs (10). The computer mouse clicks of all these subscribers is opening new avenues for information retrieval, fun, commerce, and surprises at millions of web sites. The theses of Mr. Dertouzos book is that, in a quiet and relentless way, information technology is altering our world so profoundly that the movement rivals the changes brought on by the Industrial Revolution (11). The evidence of these changes is embedded in our popular culture and have ramifications for all our institutions.

Most people welcome the notion that increased reliance on computers and information technology will change how we work and how we play (12). But what old and new issues will advancement cause? Technology is advancing at a rate well beyond our human capacity to cope with the moral and ethical dilemmas associated with it. Technology will challenge us to re-examine aspects of our lives and how we relate to others. The march of progress will also demand that we re-think : how we receive health care, how our children learn, how the elderly remain connected to society, how government conducts their affairs, how ethnic groups preserve their heritage, whose voices are heard, even how nations are formed. Increased reliance on computers and information technology will present serious challenges: poor people might get poorer and sicker; criminals, insurance companies, and employers might invade our bank accounts, medical files and personal correspondence (13).

In the early 1980s the demand for personal computers was phenomenal. Buying your own personal computer was like buying a car: you would never again have to wait for the bus, much less get bumped off onto the street (14). Because of technical limitations, these independent personal computers could not easily share information. To solve this problem researchers throughout the world began analyzing how to make large scale information sharing possible. Some organizations were skeptical about the possibility of linking independent computers. International Business Machines (IBM) could not believe that the mainframe computer and its connecting terminals could be replaced by personal computers with no central authority to control them (15). Years later, IBM and other makers of large computers would be forced to lay off thousands, having steadfastly refused to recognize the worldwide shift from a few big machines to masses of small computers as a direct result of the rapid development of the microprocessor by Intel and others. The ascendancy of the personal computer shattered the notion that a centralized machine was needed to coordinate and control people at various terminals. The "Information Marketplace" is the next step (16). This marketplace will reshape our notion of "community ", this time among millions of people at powerful machines. The growth of personal computing moved us away from computer autocracy and moved us toward computer democracy.

Ideally the Information Revolution will repeat the successes of the Industrial Revolution, except that this time brain work instead of muscle work will be offloaded onto machines. As the technology improves there are many questions that are looming and unanswered (17). Questions worth considering include:

a. Are we going to be overloaded with information, like today's web, that force our eyes and brains to do most of the sifting?
b. Will we gain greater access to needed information, along with a greater individualization of products and services, or will we drown in info-junk?
c. What should software and hardware vendors of the twenty-first century offer to propel the

Information Marketplace beyond its current stage?

d. Will computers increase the industrial performance of the world's nations?

e. What will happen to employment?

f. Will our quality of life improve through cheaper, faster and higher quality health care and greater access to knowledge?

g. Will the rich who can sooner afford these technologies get richer?

h. Will the poor be given new leverage or will they be left further behind?

i. What new gadgetry and interface might appear, and how will we use them?

j. Will ordinary citizens be better heard by their government?

k. Will our privacy be assured on this electronic network or will Big Brother end up knowing more about all of us?

l. Should we amend our laws to protect against this new technology?

m. How might war and peace be affected?

n. How will human relationships be affected by the relentless progress of technology?

Are today's technologies improving the quality of peoples lives? The resounding answer is yes. Todays' technologies offer a better deal for everyone (18). Individuals are acquiring greater control over their lives, their minds, their bodies even their genes, thanks to breakthroughs in medicine, communication, transportation and industry (19). These technologies are simultaneously providing social benefits and undoing some of the environmental damage caused in the past. Improved technology helps to conserve natural resources and reduce pollution. American farmers are so efficient that unneeded cropland is reverting to forests and parks (20). It is not surprising that the most high tech countries have the cleanest air and purest water. The Information Revolution is also fostering peaceful cooperation between people by decentralizing power. Today tyrants and demagogues are disempowered because their subjects can communicate directly with one another via the world wide web, satellite communications, etc.

Technology has given people the tools to do their jobs at home. People are also forging new communities in cyberspace and developing new relationships with their neighbors in real space. Arguably, technology has the potential to increase individual freedom and strengthen community - even though so many people argue it does neither at the moment.

Since 1965, Americans have gained an average of one hour of leisure each day, according to social scientist at the University of Maryland (21). Some "experts" even believe that by the middle of the next century, the average work week in America will be shorter than 28 hours. Today men and women have more time and opportunity than ever to pursue their dreams. So why do so many people complain about modern technology? One reason is that new technologies, like computers, usually are more trouble than they are worth - at first (22). Initially, they are hard to learn and create resentment among workers particularly the unskilled ones who fear displacement and are jealous of higher paid "experts" in the new technology.

There is no reason to assume that personal computers will remain complicated. Gadgets become more user friendly as technologies mature and marketers appeal to the masses. Today, E-mail is a novelty that can be disruptive, but pioneers are developing techniques for coping, like automated responses when there is no time to deal with an overcrowded mailbox and filters to sift out the junk mail (23).

Technological progress has also raised our overall quality of life expectations. Today, the middle class demands privileges once limited to the rich, from material luxuries to cultural experiences and intellectual fulfillment (24). People feel rushed today because they have more possibilities and demand more "entertainment stimulation". With technology we've upped the ante. Instead of corresponding with 6 or 7 people we have 150 E-mail partners ." Currently, only about 40 percent of Americans have computers, but the percentage is rising as the machines become less expensive and easier to use (25).

THE FUTURE

The future of information technology is exciting. As we approach the twenty first century, experts in the filed hypothesize that there will be more "natural communication" between humans and computers. In order for people and computers to collaborate we must "interface" or communicate as efficiently and naturally as possible. Interfaces are important because that is where people come into contact with the machinery of the Information Marketplace. Some experts, such as Michael Dertouzos at MIT, argue that the Information Marketplace will not reach its full potential until the interaction between humans and machines become closer to human-to-human communication.

1. Besides keyboards and mice, today's interface devices include trackballs, joysticks, hand held styluses for handwriting and drawing, microphones that pick up speech, and both still and video cameras for images. There are many other devices being developed around the world. Scientists and engineers are currently working on gloves that let the computer know the precise movement of your fingers. Experts are also working on glasses and head tracking helmets with mechanical, electromagnetic and optical gadgets that track eye and head movements so that the computer knows where you are looking. 2. Complete body suits that convey the motions of the torso and limbs are not readily available but they have been built (in clumsy forms) and will undoubtedly appear in the future. 3 These same devices will feed information back to you, flooding your senses with spoken information, three dimensional video, audio and "bodyo"- tactile impressions that will range from the tickle of a cats' whiskers to being driven into the back of your chair. These state of the art interfaces will forever alter the way we work and "re-create" in the near future. These new interfaces may allow individuals to work simultaneously with colleagues around the globe, order food from a French waiter in French, even though you don't know the language and even take dance lessons at home from an instructor across town. The application possibilities for these interface technologies is mind boggling.

The ability to speak to our computers is a critical part of the interface we will end up with. This will occur for two reasons: a. speaking is natural - the majority of the time we communicate with one another simply by speaking. b. Speech is the interface technology most ready to explode for practical applications. It is clear to everyone involved that developing a system that enables computers to understand speech will dramatically expand technologies role in our daily lives. The applications for a language recognition system would be far reaching. 4. For example, a navigational-aid program in the car could help you find your way through an unfamiliar city as you drive. Another language recognition system on your home computer could guide you through a maze of potentially useful services. It would be convenient for speech systems to act as travel agents assisting consumers to book flights or make car and hotel reservations.

5. A phone system that translates language is also within the reach of speech-understanding technology. The system would work like this: say you want to call from the United States to an associate in South Africa. After you connected with your party, you would speak into your phone in English and you would immediately hear a computer generated paraphrase of what you said, to ensure the computer understood you. At the same time, the machine would translate and present your sentence to the other party. If the computer did not understand, you would hear the incorrect paraphrase hit an abort button and try to convey your message with a different sentence.

Speech understanding systems could well dominate tomorrow's interfaces. Developing a proficient system has been an engineering challenge however. For decades computers have been notoriously poor at comprehending ordinary human speech. Many skeptics have written off the possibility of genuine conversation between people and machines. Engineers, scientists and linguists are still analyzing the problem however.

Lesson Plans

Lesson 1

Objective:

1. Students will explore the factors that lead to social change.

2. Students will be able to explain how technological advancements serve as a catalyst for change in society.

Material: Transparency depicting the main points of the mini-lecture

Strategies:

1. Students in this senior Sociology class will begin examining the question, how does technology affect society? Some sociologists believe that technological advancement is the major catalyst that ignites societal change.

Teacher and students will begin a dialogue exploring the monumental changes that occurred between the Paleolithic Age and the Neolithic age in early human history. During the Paleolithic Age, people lived in small hunting and food gathering bands that wandered from place to place in search of food. Overtime, people learned to make tools, clothes, developed language and discovered how to make fire. These "technological achievements" had significant implications for the course of human history. During the Neolithic Age a

revolutionary thing occurred. Humans were able to use the technology they had developed to grow most of their food.

The change from food gathering to food producing brought many changes in the way people lived. For one thing, food production made it possible for people to settle in one place and develop villages. Increased food supplies in the Neolithic age resulted in increased population and specialization.

2. Students will be broken up into groups of four for a brainstorming session. One student will be the Scribe, responsible for writing while another student will be the Spokesperson, responsible for reporting to the class.

Create a list of answers to this brainstorming question: What are some events, inventions, movements that have led to social change in America?

Students will compile their lists on the board after five-eight minutes. Students will be encouraged to explain their answers.

Closure:

Today we began exploring how advancements in technology cause changes in the way people live. What effect did technology have on the evolution of early humans?

Lesson 2 (Two days)

Objective:

1. Students will be given a chronological survey of how computer technology developed and evolved.

2. Students will define terms associated with computer technology

Materials:

The Age of Spiritual Machines, p. 261- 280

Timeline handout

Glossary:

1. bit = An abbreviation of binary digit, one of the two numbers -0 and 1 - used to encode computer data. A bit is expressed by a high or low electrical voltage.

2. byte = A group of eight bits used to encode a single letter, number or symbol.

3. chip = A small piece of silicon that is a complete semiconductor device or integrated circuit.

4. microprocessor = An integrated circuit that provides in one chip functions equivalent to those contained in the central processing unit of a computer. A microprocessor interprets and executes instructions and usually incorporates arithmetic capabilities and some memory.

5. semiconductor = An element whose electrical conductivity is less than that of a conductor, such as copper and greater than that of an insulator, such as glass.

6. Transistor = A semiconductor device that acts primarily either as an amplifier or as a current switch.

7. Wafer = A thin disk of semiconductor material on which many chips are fabricated at one time. The chips are subsequently separated and packaged individually.

Strategies:

The teacher will conduct a mini-lecture explaining each event posted on the timeline and explaining the significance of each glossary word.

This time line is adapted from The Age of Spiritual Machines by Ray Kurzweil.

1940   ABC, the first electronic computer is built
_____

1944   Howard Aiken completes Mark I. Using
punched paper for programming and vacuum

tubes to calculate, it is the first computer built

by an American

_____

1946   The world's first fully electronic, general
purpose digital computer is developed it's

almost one thousand times faster than Mark I

_____

1947   Transistor is invented. This device functions
like a vacuum tube but is able to switch currents

on and off at highers speeds. The transistor

revolutionizes microelectronics, contributing to

lower costs of computers and leading to the

            development of mainframe and minicomputers.

_____

1955

            The space program and the military recognize

the importance of having computers with

enough power to launch rockets and missiles.

Both organizations supply major funding for

research.

_____

 1964   Gordon Moore predicts that integrated circuits
will double in complexity each year. This will

become known as Moore's Law and prove true

for decades.

_____

 1970   The floppy disc is introduced for storing data
_____

 1971   The Intel 4004, the first microprocessor, is
           introduced by Intel.

_____

 1975   The first personal computer, the Altair 8800, is
           introduced. It has 256 bytes of memory.

Closure:

Examine your table closely, based on what we reviewed today what do you think were some significant inventions/discoveries that enabled the development of computer technology? Explain your thinking.

Lesson 3 (2 days)

Objective: 1. Students will exercise their reading comprehension skills..

2. Students will compose a one page essay based on their selection of writing prompt.

Materials:

Handout copies of "Computers are poised to become something completely different" (Health Science Section of New Haven Register 2/25/99)

Dictionaries

Procedures:

a. Day 1 Class Notes - Technology in Every-Day Life:

Some of tomorrow's technologies are right around the corner, according to futurists. Imagine ....

      · Personalized computers: Your computer will recognize your voice and carry out your commands.
      · Next generation TV: Your television set will be large and flat and hang on the wall like a painting.
      You will be able to use it as a computer monitor and/or for holding video conferences.
      · Cyber cash: You will carry around "smart cards" that look like credit cards and use them for
      buying anything from soda in a vending machine to equipment from overseas.
      · Smart materials: New materials will be able to give off warnings by changing color when they
      are about to break.

b. Day 1 Classwork

Students will define these terms in class before reading the article:

conglomeration, cranium, spreadsheet, miniaturization, translate, logic, ingrained, bandwidth

c. Day 1 Homework

Begin or complete reading the handout article. Write down at least three questions, concerns or comments inspired by the reading.

d. Day 2 Discussion

Discuss the major implications of the article and encourage student centerd questions, comments or concerns.

e. Day 2 Writing Assignment

Choose one of the following writing prompts to compose a one page essay.

1. Learning about the impact of technology is.....

2. Computers will / will not make books obsolete in the future because ...

3. In the future computers will ......

ENDNOTES

1. Osborne, John. The Silent Revolution - The Industrial Revolution in England as a Source of Cultural Change, p. 21 2. Ibid p. 23 3. Ibid p 23 4. Ibid p. 25 5. Ibid p. 25 6. Ibid p. 27 7. Ibid p. 36 8. Ibid p. 37 9. Ibid p. 37 10. Dertouzos, Michael. What Will Be, p. 4 11. Ibid p. 5 12. Ibid p. 5 13. Ibid p. 5 14. Ibid p. 31 15. Ibid p.31 16. Ibid p. 32 17. Ibid p. 22 18. Tierney, John. Our Oldest Computer Upgraded (New York Times Magazine 9/28/97) 19. Ibid p. 46 20. Ibid p. 46 21. Ibid p. 47 22. Ibid p. 47 23. Ibid p. 47 24. Ibid p. 47 25. Ibid p. 47

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Dertouzos, Michael, What Will Be : How the New World of Informaion will Change Our Lives New York, New York: Harper Collins, 1997 Kurzweil, Ray, The Age of Spiritual Machines - When Computers Exceed Human Intelligence. New York, New York: Penguin Putnam, 1999 Tenner, Edward, Why Things Bite Back - Technology and the Revenge of Unintended Consequences. New York, New York: Alfred A. Knopf, Inc., 1996 Wilson, William, When Work Disappears - The World of the New Urban Poor. New York, New York: Alfred A. Knopf, Inc., 1997

STUDENT READING LIST

(All readings will be reserved in my classroom)

1. Katz, Abram. Computers are poised to become something completely different. New Haven Register Health Science Section, 2-25-99. This news article explores the history of computers and examines trends in computer technology. The author, the Science Editor of the New Haven Register, does a fine job explaining the computer jargon so that readers at different levels will understand. 2. Levy, Stephen. The Power of Invention. Newsweek Extra, 2/9/98 This specialty issue of Newsweek focuses on how an explosion of discoveries changed our lives in the 20th century. Readers can examine various articles that discuss how inventions have affected how we work, how we live, how we fight and how we heal. The magazine is full of informative timelines, captions and fun bright fun graphics. 3. Tierney, John. What Technology is Doing To Us. The New York Times Magazine, 9/28/97 This special issue of The New York Times Magazine delves into how technology is impacting American culture. The entire issue is filled with provocative articles. Articles explore how technology is making us faster, richer, smarter, more alienated, more materialistic and simultaneously a little more crazy