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ABSTRACT

This compendium of interdisciplinary learning activities is designed to assist technology education instructors who are conducting an introductory secondary-level course in communication technology. The 12 activities, which are sequenced from introductory, low-cost activities to more advanced and more involved activities, deal with the following topics: the role of communications in expanding the world, conducting a neighborhood survey to count communications devices, constructing interference-free messages, fiber-optic simulation, assembly and use of a telegraph system, radio communication, satellite communication, basic principles of lasers, laser fiber-optic communication, principles of desktop publishing, principles of electronic mail, and reflection holography. Each activity is designed as an autonomous unit, and each includes an overview, equipment list, step-by-step description of the procedure, suggested evaluation techniques, and discussion of the activity's interdisciplinary aspects. Substantial bibliographies follow many of the activities. (MN)

COMPENDIUM
OF INTERDISCIPLINARY ACTIVITIES
FOR AN INTRODUCTORY COURSE
IN COMMUNICATION SYSTEMS
AT THE SECONDARY LEVEL

by

David J. Lasko

Submitted in Partial Fulfillment

of Requirements for the

Master of Science Degree (Plan C)

Central Connecticut State University

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FOREWORD

This selection of communication technology activities is designed for the technology education instructor. Each activity is assembled as an autonomous unit, featuring an overview, equipment list, step-by-step procedure, evaluation techniques and bibliography. A discussion of the interdisciplinary aspects of each activity is also included, offering a range of interesting things to do or questions to answer.

These activities are sequenced from introductory and low-cost through the more involved, where equipment costs are higher. The bibliography section of each activity can be used as a springboard to new or expanded material.

Please use these student-oriented activities to stimulate further investigation of communication technology in our society.

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TECHNOLOGY LEARNING ACTIVITY #1

COMMUNICATIONS: EXPANDING THE WORLD

A. Overview

This activity describes communication technology in terms of how it expands our individual worlds, by instantaneously bringing us sounds and images from around the globe. Until very recently, progress in communication technology was solely dependent on advances in transportation technology. This situation changed drastically with the invention of the telegraph. In this century, our methods of communication have changed more rapidly and radically than in the many thousands of preceding years.

The first important communication technology was the invention of the written word, which made it possible to record, store and retrieve thoughts. The development of movable type and printing presses later gave this written information an accessibility to the masses.

Tremendous innovations in telecommunication technology have created a virtual global revolution. Telegraphy, using scientific principles of electric current to overcome the limitations of long-distance communication, changed human ideas about time and space.

Today, the access to mass media offers a powerful means of influencing public opinion. This power raises many important issues regarding the roles and responsibilities of advertisers and politicians. We live in an "age of images", giving us

instant access to every corner of the globe through satellites and television, with new impacts on our lives and governments (Galey, 1988).

In this activity, students will view a videotape presentation designed to foster an appreciation and understanding of the central role of communication technology to civilization. Students will also learn about the basic mechanics of communication, through exposure to a communication model.

B. Major Concerns to be Addressed

1) Communication technology has been responsible for increased literacy and knowledge, across class structures.
2) Communication itself is a deeply basic human activity (Galey, 1988).
3) Communications technology represents an ongoing process of technological change.
4) Communication technology is creating the effect of a smaller, more immediate world.

C. Equipment and Supplies

1) Videotape You, me and technology. Lesson # 7. Communications: The expanding world (18:46). Arnesen, S.
2) VCR or videotape player.
3) Television
4) Paper and pencils.

D. Procedure

1) Have students identify the kinds of communication involved in each of the following activities. Suggest that students create flowchart diagrams showing all steps and people involved in:

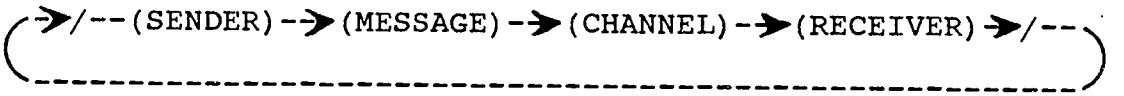
   a) Arranging a cruise to the South Pacific.

   b) Selling a 1965 Mustang.

   c) Learning how to operate a new Japanese camera.

(Galey, 1988)

2) Introduce the following communication model, defining the terms used. Particularly emphasize that the message can be groups of symbols that have no meaning in themselves. Any meaning to that group of symbols is given by the sender and receiver. The channel is the route, or medium, of message travel. Assign to each item on the flowcharts developed in the previous activity one of the following descriptors:



(Galey, 1988)

3) Set up the VCR/TV and show the video program.

   Summary of video program: High school students, watched by extraterrestrials, produce a television

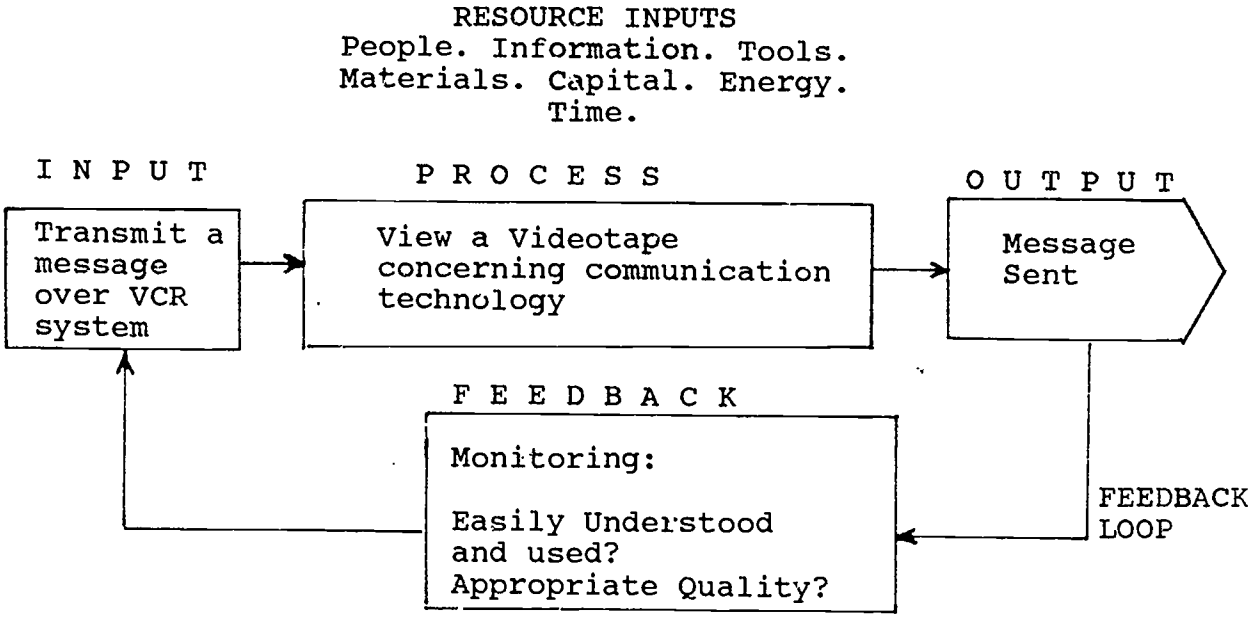
program about communication technology. Archival film clips and interviews help dramatize the communications revolution, from simple speech, through writing and printing, to modern developments in which sound and image are transmitted over wire and through the air. The history of the telephone company, as a natural monopoly and then as a subject of anti-trust action, is discussed. The breakup of the Bell system is debated. Fiber optics, satellite transmission, and telecommunications have brought people closer together, but they create many unresolved problems.

4) Return to the communications model, and have students list as many examples of message senders (e.g., teachers, authors, politicians) with their expected receivers (e.g., students, readers, voters) as possible.

5) Introduce the concept of noise, internal and external, as any interference in the receiver's getting the entire message. Have students describe examples of internal noise (e.g., tiredness, poor vocabulary, a stereotyped view of the sender or receiver) and external noise (e.g., the smell of school lunch, room too warm, jet flying over the building). Ask students how technology helps in the reduction of internal and external noise in the communication process. Discuss print, textbook design, television, radio, and other examples (Galey, 1988).

E. Interdisciplinary Aspects of the Activity

1) System of Technology



Identify the role of the following resources in the system above: People, Information, Tools, Materials, Capital, Energy and Time.

(University of the State of New York [UNY], 1988)

2) Math: Using copies of flight schedules, discuss the impact of time zone differences on elapsed time between departure and arrival; have students compute elapsed time for different flights. Have students trace the history of air travel, regarding communication; investigate the meaning of air resistance, lift, absolute ceiling and rate of climb; determine how each is calculated (Galey, 1988). Have students calculate the cost effectiveness (performance/cost) of various communication mediums and make charts or graphs to illustrate their findings (UNY, 1988).

3) Science: Have students talk to older relatives or friends about the 1906 San Francisco earthquake, the 1937 Hindenburg disaster, and the 1989 San Francisco earthquake. How soon afterwards did they hear of each, and which communications technology bore the news? What advances in science occurred between these events? What new technologies brought faster ways of reporting? (Galey, 1988).

4) English: It is common to use the telephone in many instances in which writing was once required; it is easier to call than to write a thank-you note. Discuss this phenomenon, and speculate about its possible effect on the writing and reading skills of school-age children. Discuss word-processing on computers, and debate the effect of such technology on the quantity/quality of writing. Have students compare the printed and filmed presentations of the same narrative (e.g., The Diary of Anne Frank, To Kill a Mockingbird, Shakespearean plays), and discuss the strong and weak points of each medium in telling a story (Galey, 1988).

5) Social Studies (Human and Social Impacts): Research and discuss the effects of the extended use of television on family interaction. Discuss the impact of communication technology on political campaigning, democratic processes, and world relations (e.g., compare

presidential campaigns of Lincoln and Reagan, impact of projected election returns in a national election before the polls are closed on the west coast). Lead a student discussion on the impact of motion pictures and television on their individual lives (Galey, 1988).

6) Psychomotor Skills: Students will develop or improve eye-hand coordination and manual dexterity in writing or keyboarding responses to this activity.

7) Safety and Health: Assure the safe use of electronic equipment (VCR and television), and safe viewing habits regarding the video screen. Cite the statistic that 35% of Freshmen entering college have 15% hearing loss; at the end of the Sophomore year the hearing loss is 30% (Piel & Truxal, 1975); discuss the potential physical and psychological hazards of recently developed communication devices, such as sound and video equipment (Galey, 1988).

8) Career Related: Students will observe or engage in activities touching on careers in the fields of broadcast journalism, including that of video camera and lighting technician, sound mixing, video editing and news anchorperson (Galey, 1988). Students will also observe the role of a technology education instructor.

9) Creative Problem-Solving: Opportunities are provided through the construction of communication flowcharts, and in understanding and applying the communication model to everyday events.

10) Transfer of Learning: The application of the communication model to other communication experiences.

F. Evaluation Techniques

1) Have students research and report (written or oral) on the communication skills that are required in all customer service applications. Why are these skills as important as the service being provided? Examples might be: Parts Manager, Travel Agent, Receptionist, Hotel Desk Clerk.
2) Have students research and report (written or oral) on our society's current awareness of and fantasies about communication technology, as represented in print or on film.
3) Construct and administer a test requiring students to identify and describe the components of the communication model.
4) Have students research and report (written or oral) on one area of concern regarding television technology, such as privacy and the legality of recording programs on the VCR at home.
5) Have students research and report (written or oral) on the significance of one of the following technologies: a) movable type; b) telegraphy (Galey, 1988).

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TECHNOLOGY LEARNING ACTIVITY #2

SURVEY THE NEIGHBORHOOD: HOW MANY COMMUNICATION DEVICES IN EACH HOUSEHOLD?

A. Overview

While most people realize that communication devices are an important part of daily life, few are aware of the extent to which they make themselves available to communication technology (Thomsen, 1985). We need to understand that we spend much of our lives engaged in the process of communication, or being affected by communication about us. Likewise, it is important to recognize that we employ many forms of communication daily, and that how we communicate can influence our existence quite considerably (Katsh, 1989).

In this activity, students will create a questionnaire to assist in the collection of data concerning the pervasiveness of communication technology. Students will make decisions as to how best to phrase and order the questions, and how to generate copies of the finished instrument. Contacting people and recording information for the survey will be done by the students in small groups of two or three. Students will analyze the data to determine the frequency of specific communication devices as they occur in each household. Student discussion to follow will define need and want in relation to the consumption of material goods as well as the importance and pervasiveness of communication technology in daily life (Hayden, 1986).

B. Major Concerns to be Addressed

1) Questionnaires are instruments designed to collect data.
2) Survey questions can be biased or neutral.
3) Survey data-gathering can be time consuming.
4) Analysis of data can be qualitative or quantitative.
5) Creation of a survey instrument requires careful writing, layout and production.
6) Communication devices are constructed of various materials, and consume energy in production and use.
7) Communication technology in the home can take many forms.
8) Life-styles are reflected through consumption of material goods, such as communication devices.

(Hayden, 1986)

C. Equipment and Supplies

1) Samples of reports, instruments or questionnaires.
2) Pencils, pens and paper.
3) Xerox copier/ditto master and mimeograph copier.
4) Scissors.
5) Tape or glue.
6) Typewriter/word processor.

(Hayden, 1986)

D. Procedure

1) Introduction to Questionnaires

a) Discuss surveys as a data-collection technique.
b) Examine several instruments with students.

2) Give Background Information

a) Have students brainstorm ideas on what communication devices are found in homes typical to the area.

b) Discuss with students the idea of consumption of material goods.

c) Lead a student discussion on the difference between a "need" and a "want".

d) Discuss with students the issue of researcher bias.

e) Determine which students will work together, in teams of two or three students each.

f) Lead a discussion on the topic of etiquette in doing research work within private homes.

g) Discuss with students the concept of anonymity, and how to assure people of the researcher's respect for maintaining it.

3) Design the Instrument

a) Have the class identify different questions to be used in the survey.

b) Discuss with students how the wording of questions can sometimes alter meanings and provoke a set response.

c) Have students generate questions for the survey, by hand, typewriter or word processor.

d) Students then arrange the questions in a proper order for the survey (Hayden, 1986).

e) The instructor reviews and approves each student-generated survey (Johnson, 1992) and final revisions are made.

f) Students then produce the completed instrument, in multiple copies.

4) Collect the Survey Data

a) Determine with students what the research territory of each group will be.

b) Have students practice asking survey questions, and recording data, in class.

c) Select the most appropriate time to conduct a survey.

d) Have the student groups conduct the survey, walking from door to door, meeting with people from four or five households.

5) Analyze the Data Collected

a) Have students meet in the classroom, after conducting the survey, to discuss the experience.

b) Discuss with students ways in which to organize and analyze the data.

c) Have the class break into the original research groups.

d) Have each student grouping decide which data analysis method to use.

e) Students then manipulate and code that data; then interpret the data and record results.

6) Implications of Survey Research

a) Each group of students selects a spokesperson, who presents survey results to the class.

b) Lead student discussion about the validity of the survey.

c) Define with students "needs" and "wants" with respect to consumption of communication devices.

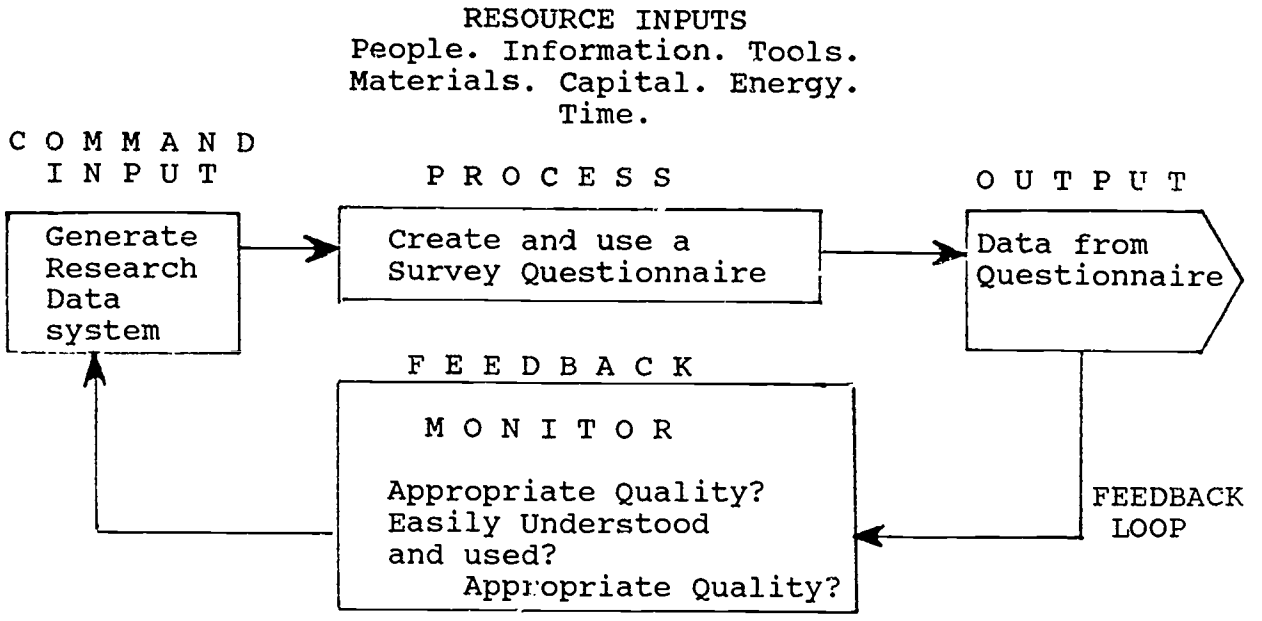
d) With the class, indicate who would be interested in the results of this research.

e) Promote classroom discussion of researcher bias, and how certain wordings on questions can lead to desired responses.

f) Discuss with the class personal feelings and experiences regarding this activity (Hayden, 1986).

E. Interdisciplinary Aspects of the Activity

1) System of Technology



Identify the role of the following resources in the system above: People, Information, Tools/Machines, Capital, Energy and Time.

(University of the State of New York [UNY], 1988)

2) Math: Use of addition, subtraction, multiplication and division in arranging and tabulating data generated by the questionnaire. The concept of ratios employed when displaying data generated by the questionnaires. Basic statistical approaches to the analysis of data.

3) Science: Introduction to the scientific method of research, through exposure to the questionnaire/survey instrument, and manipulation of data. Exposure to one type of printing technology in producing multiple copies of the questionnaire (e.g., electrostatic reproduction, if xerox copier is used).

4) English: Writing clear, unbiased and grammatically correct items for the questionnaire. Accuracy in spelling and punctuation. Oral use of technical vocabulary relating to surveys and the collection of data.

5) Social Studies (Human and Social Impacts): Discuss the impact of so many forms of communication technology in the American home. Is too much information being provided? If someone has a radio, a television, a VCR, a compact disc player, a walkman, a telephone and an answering machine, is it really necessary to know how to read and write? When is too much communication technology a bad thing? Some households have more than one television. What does this say about the inhabitants regarding consumption of material goods? Speculate about the impact of electronic communication technology on the reading, writing and thinking skills of the student of the future.

6) Psychomotor Skills: Students will develop or improve eye-hand coordination and manual dexterity in writing or keyboarding information relating to the questionnaire, laying-out and preparing the reproduction master of the questionnaire, reproducing the questionnaire, and in recording, manipulating and displaying data gathered by the questionnaire.

7) Safety and Health: Discuss the potential physical hazards allied to the use of copier machinery. Discuss

the potential physical hazards associated with recently developed home communication equipment (e.g., sound and video equipment) (Galey, 1988). Assure safe use of construction materials and tools (e.g., blades and scissors) in the classroom. Establish procedures for clean-up after the activity. Discuss how rapid communication, such as the type made possible by electronic communication devices found in nearly every home, can alert people to impending emergencies ([UNY], 1988).

8) Career Related: Students will engage in activities related to careers such as that of the research scientist, census-taker or pollster, and statistician. Students will also observe the role of a technology education instructor.

9) Creative Problem-Solving: Opportunities are provided to students, while in a small-group format, through the construction of the questionnaire, and in collection, analysis and display of data generated from the questionnaire.

10) Transfer of Learning: Application of problem-solving techniques made possible by the survey technique, to other technical problems. Discuss the wide ranging applications of the scientific method.

F. Evaluation Techniques

1) Have students maintain a daily log of their personal use of communication technology for the period of one week. Particular attention must be given to the amount of time spent on each use of a particular communication device. Each student must then project the amount of time spent with each communication device over the course of one year and report orally to the class on their findings.
2) Have students create their own individual surveys designed to test attitudes towards various home communication devices. Have the students canvass a specific, designated group (e.g., doctors, plumbers, all teachers in the school) and report findings orally to the class.
3) Construct and administer a test, requiring students to describe the process of creating and employing a questionnaire to collect data.
4) Evaluate listening, reading and viewing habits of individual students during class.
5) Observe student participation in group activities during class.
6) Break the class into two debate teams. Plan for the two groups of students to debate the following in class: the federal government should/should not restrict the amount of television viewing done by school-aged children. Have students prepare for this debate a week in advance.

G. Bibliography

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TECHNOLOGY LEARNING ACTIVITY #3

CONSTRUCT AN INTERFERENCE-FREE MESSAGE

A. Overview

When two people stand face-to-face in a room and speak to each other, they form a basic communication system, including an input, a process, and an output. The input is the message that the sender wishes to communicate; the process is wording that the sender uses; and the output is the message actually received by the other person.

Because we function as an element in this type of basic communication system so many times every day, we may be jaded to the difficulty of interference elimination, even in this simplest of communication systems. However, interference can occur during each stage of the system. During the input stage, the sender may create interference through a poorly constructed message. In selection of ambiguous words or inaccurate phrasing, the sender may produce a message that cannot communicate the idea he wishes to send. During the process stage, when the sender actually speaks the message and sound is carried through the air to the receiver, many sources of interference are possible. Noise in the room, for example, may create so much interference that the words from the sender are obscured. At the output stage, the receiver can experience two forms of interference; misinterpretation of a well-constructed message, or inability to understand a message that is garbled to begin with.

When standing face-to-face in the basic communication system described above, the sender and receiver can see each other's facial expressions, and ask questions of each other to clarify the message. In doing this, feedback has been added, closing the loop in the communication system and providing the sender with information needed in order to learn how to better communicate.

Interference problems in communication become even more likely to occur over long distances, when high technology is involved at the process stage of communication and when feedback is difficult to obtain. It becomes critical to eliminate as much interference as possible from the system before the message is communicated. The message must be well-constructed at the input stage, if it is to survive the journey intact. The message must be constructed to be as interference-free as possible.

In this activity, students will practice eliminating interference from the communication system. Students will assume the roles of input, process and output in a simple communication system, and attempt to transmit an error-free message. In doing so, the student will develop an appreciation of an inherent difficulty in communication (Buck, Allen & Davis, 1991).

B. Major Concerns to be Addressed

1) Communication systems involve stages of input, process (transmitter, channel and receiver) and output.

2) Interference can occur at any stage of the communication system.

3) Feedback in a communication system can eliminate the effect of interference.

4) Communication interference can take many forms.

(Buck, Allen & Davis, 1991)

C. Equipment and Supplies

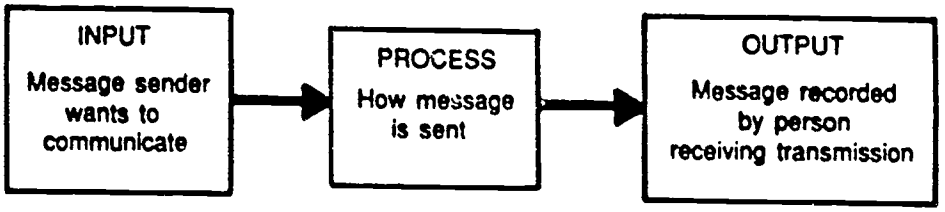
1) Pencils and paper.

2) Radio, with loudspeaker.

D. Procedure

1) Introduction to the basic communication system.

a) Discuss with the class the stages of basic communication, and definition of terms related to it:

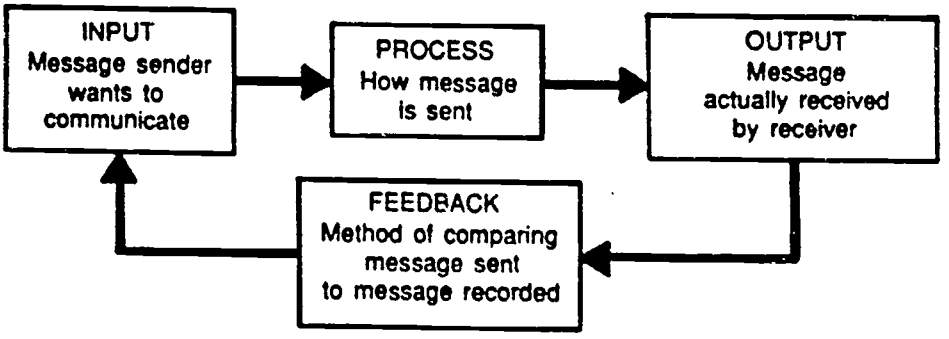


* Communication: Process by which information is exchanged between individuals/machines through a common system of signs, symbols or behavior.
* Interference: Anything that blocks the process.
* Input: Stage one of communication; the message that the sender wants to communicate.

* Process: Stage two of communication; the means by which the message is sent.
* Output: Stage three of communication; the message is recorded by the person/machine receiving the transmission.

b) Discuss with the class the meaning of interference in communication, with particular regard to the three stages of communication:
* Stage one (Input): Sender creates a poorly constructed message.
* Stage two (Process): Noise is created during transmission of the message. A common example of noise interference is radio static.
* Stage three (Output): Person/machine receiving the transmission misinterprets the message, or receives a poorly constructed message.

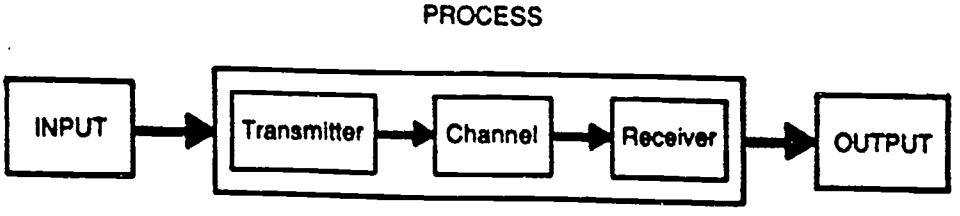
c) Discuss with the class the importance of feedback in a basic communication system:



* Feedback is a term used to describe the contact between sender and receiver.

* Feedback serves to close the loop in the basic communication system, by providing a means to compare the message sent to the message received.
* Feedback tells the sender whether or not the receiver has understood the message correctly; and if not, helps in determining the source of interference.

d) Introduce the class to the parts of the process in a basic communication system:



* Transmitter: Means of sending the message.
* Channel: The route a message takes.
* Receiver: Means of accepting a transmitted message.

2) Conduct an Activity to Illustrate Input, Process, Output and Interference.

a) Divide the class into groups of three students each. Place the group members in chairs, one beside the other. Label the three group members as "input", "process" and "output".

b) Tell the group members that during the activity, the "input" person will read a message to the

"process" person, who will in turn relay the message to the "output" person. The "input" person will read the message only one time. The "process" person will not record the message, but repeat it from memory. The "process" person will not question the "input" person, or ask for clarification of the message. Similarly, the "output" person cannot ask the "process" person to repeat or clarify the message.

c) Provide the "input" person in each group of three with a written message that has been purposely written to be interference-laden.

d) Tell the "input" person to read the message to the "process" person. Instruct the "input" person not to shout during the reading of the message, but to use a normal voice.

e) Provide a source of noise interference, such as a radio talk show, to be played when the "input" person reads the message to the "process" person.

f) The "process" person will not record the message on paper, but will attempt to pass the message as he remembers it to the "output" person. Instruct the "process" person not to shout, but to use a normal voice, and to pass the message only once.

g) The "output" person will then record the message, as he hears it, on paper.

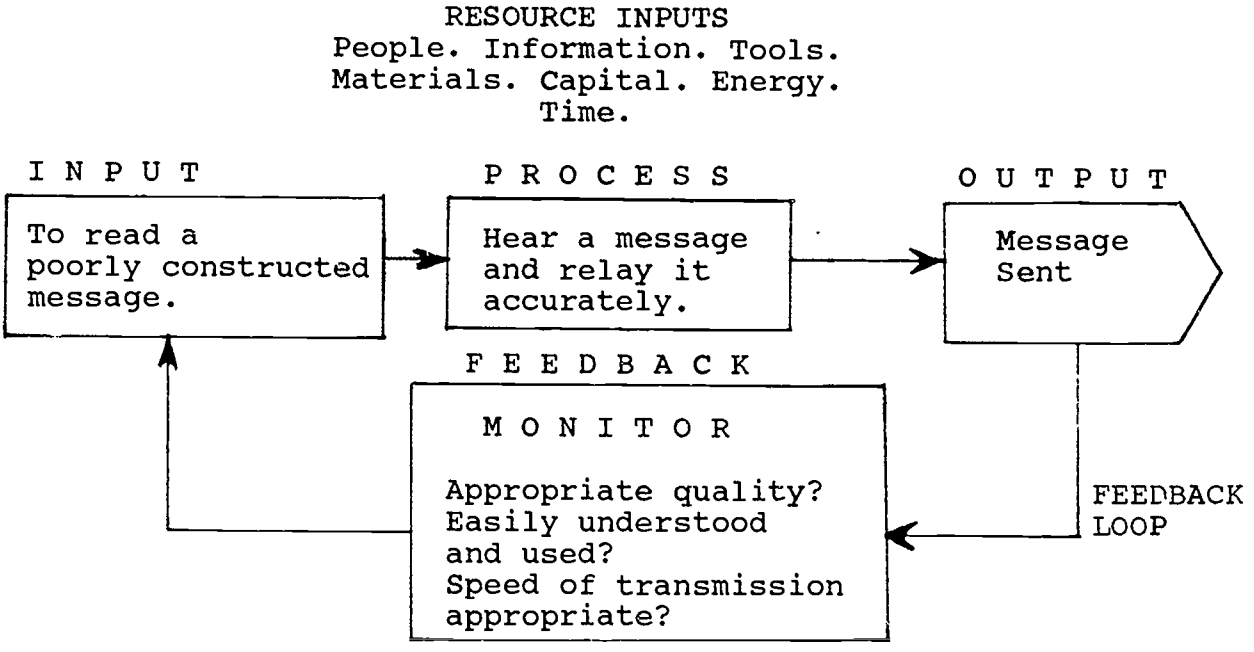
h) Have students, in their groups, compare the message-sent to the message as received. Discuss

with the class the sources of interference in the activity; the poorly written message and the noise during transmission. Discuss how interference often occurs during the process stage, and emphasize the importance of beginning with a message that is as interference-free as possible.

i) To illustrate the importance of feedback to the communication system, hand out new garbled messages to the three-person groups, and repeat the activity; but this time, let the "input", "process" and "output" persons ask each other questions to clarify the message. Compare the two recorded "output" messages to see the difference in fidelity to the original (Buck, Allen & Davis, 1991).

E. Interdisciplinary Aspects of the Activity

1) System of Technology



Identify the role of the following resources in the system above: People, Information, Materials, Tools/Machines, Capital, Energy and Time.

(University of the State of New York [UNY], 1988)

2) Math: Using a stopwatch, record the time it takes to transmit a message during the activity, both with and without feedback. Figure ratios for the times recorded for each group of three students, and display the results in a graph or chart.

3) Science: Discuss the physical nervous system that allows human beings to communicate in the activity; the workings of the ear, eye, tongue and larynx. Explore in discussion the ways in which communication technology seems to mimic these systems, in a sense offering artificial eyesight and speech.

4) English: Reading and writing clear, accurate messages as the "output" stage of the communication activity. Accuracy in spelling and punctuation. Oral use of technical vocabulary.

5) Social Studies (Human and Social Impacts): Discuss the importance of feedback in communication, by citing examples of misinterpretation over the course of history (e.g., misunderstood military intelligence, failed rescue attempts due to faulted communication). Discuss the importance of eliminating interference from the "input" stage of communication, in everyday terms (e.g., newswriting, broadcasting, legal documents).

6) Psychomotor Skills: Students will develop or improve eye-hand coordination and manual dexterity in recording messages while role-playing as the "output" stage in the group activity.

7) Safety and Health: Discuss the importance of eliminating interference from the "input" stage of a communication system (e.g., highway signage, or dosage information on medicine bottles). Talk about the need for appropriate feedback in communication between a doctor and a patient. Establish procedures for classroom clean-up.

8) Career Related: Students will engage in activities related to careers in all fields of journalism, customer service, counseling, and psychiatry. Students will also view the job of technology education teacher.

9) Creative Problem-Solving: Opportunities are provided to students, while in a small-group format, when employing feedback in order to transmit an error-free message.

10) Transfer of Learning: Application of the communication model to other communication systems. Use of feedback techniques generated during the small-group activity to facilitate communication in other life situations.

F. Evaluation Techniques

1) Break the class into two telephone-chain teams. That evening, transmit a one-paragraph message to the first member of each team by telephone. These students must then call the next link on the chain and transmit the message, and so forth, until the last member of each chain returns the message. Grade the teams on accuracy and speed of return.

2) Construct and administer a test requiring students to identify and define the parts of a communication model.

3) Have students research and report (written or oral) on one historical event in which a miscommunication played a central role. Students must identify the source of interference and the quality of feedback in that instance.

4) Evaluate listening, reading and viewing habits of individual students during class.

5) Observe student participation in the group activity during class.

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TECHNOLOGY LEARNING ACTIVITY #4

ASSEMBLE AND USE A FIBER-OPTIC SIMULATOR

A. Overview

Most long-distance and some local telephone services now use laser light traveling over a thin glass fiber, called a fiber-optic cable, to transmit telephone signals (Harms, 1988).

Fiber-optic technology has gained increasingly wider use for communication purposes because it can transmit substantially larger volumes of information in the form of computer data, voice messages and video over longer distances than can conventional copper-wire and co-axial cables (Hecht, 1987).

The information that may be passed over a ¼" diameter fiber-optic cable would take a conventional cable of at least 8" diameter (Harms, 1988).

This has resulted in fewer and smaller space-saving transmission cables. Another decided long-term advantage of optical fibers is their low manufacturing cost. Glass is basically silicon, the second most abundant material in the earth's crust; common sand is an oxide of silicon. By contrast, copper is becoming increasingly scarce and expensive. Copper cables can suffer from static, which interferes with telephone and communication lines (Hecht, 1987). Because optical fibers carry light beams, they are free of electrical noise and interference, and cannot be "tapped" without telltale signs (Grant, 1988).

In this exercise, students will be provided an opportunity to construct a basic model for a fiber-optic communications system. Students will also be asked to transmit a message over the system. In doing so, the student will experience a way in which coded messages are conveyed by means of light waves.

B. Major Concerns to be Addressed

1) Light waves can be used to transmit signals.
2) Signals can be organized into codes, in order to effect communication.
3) Light waves can be channeled and directed.

C. Equipment and Supplies

1) Clear cast acrylic rod (¼" diameter, 12" long).
2) Electrical tape.
3) Ordinary 2-cell flashlight.
4) Piece of wood (3/4" x 2" x 2").
5) Drill press.
6) Band saw.
7) Safety equipment

(Kellum & Murray, 1991)

D. Procedure

1) Put on safety glasses.
2) Obtain permission from instructor before operating equipment.

3) Cut the acrylic rod to a 12" length, using the band saw.

4) Cut the piece of wood to 3/4" x 2" x 2", using the band saw.

5) Drill one ¼" hole in the center of the wood piece, using the drill press.

6) Polish the ends of the acrylic rod until they appear transparent.

7) Place one end of the acrylic rod into the hole in the piece of wood.

8) Attach the flashlight to the piece of wood, with the electrical tape.

9) Turn on the flashlight, and observe the light coming through the clear rod.

10) Write a short, one-sentence message.

11) Translate that message into Morse code, or develop your own code system.

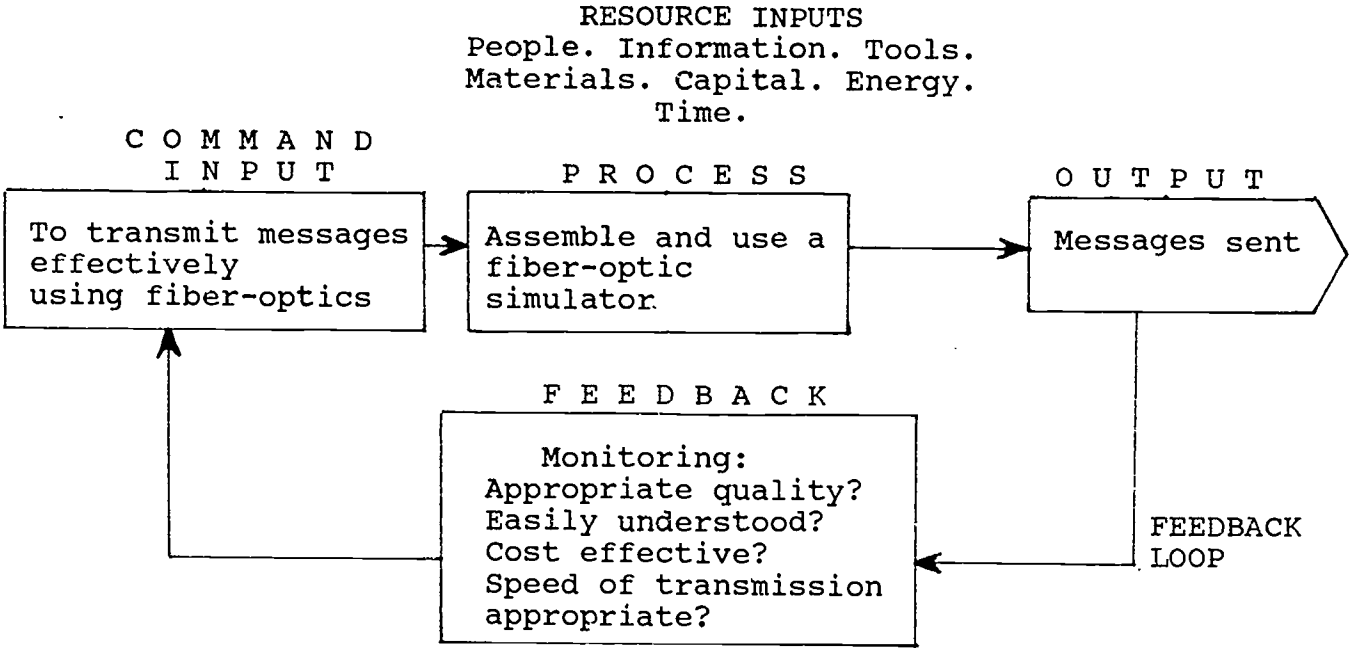
12) Send the coded message, using the flashlight, through the simulator.

13) Receive and decode a message sent through the simulator.

(Kellum & Murray, 1991)

E. Interdisciplinary Aspects of the Activity

1) System of Technology



Identify the role of the following resources in the system above: People, Information, Tools, Materials, Capital, Energy and Time.

(University of the State of NY, 1988)

2) Math: Consider the use of number codes for sending messages. Consider digitized code for transmission of information. Compare methods of communication as to distance, cost and speed; develop charts and graphs to present findings. Use of addition, division and multiplication in setting dimensions for construction of the simulator.

3) Science: Discuss the composition of fiber-optic cables. Discuss laws of physics concerning light. Use

of fiber-optics in surgical procedure. Energy coversion, from light to electric pulse. Modulation of intensity of light, enabling fiber-optic cables to carry multitudes of encoded messages, simultaneously. Speed of communication with light versus other mediums.

4) English: Writing clear, grammatically correct messages for transmission. Oral use of technical vocabulary. Writing a clear, concise translation of the coded message received.

5) Social Studies (Human and Social Impacts): Discuss the impact of smaller, and fewer, communication cables. Consider the cost-effectiveness of glass cable versus copper wire, and the impact of that cost savings. Discuss the environmental impact of glass versus copper as a material for cable.

6) Psychomotor Skills: Students will develop or improve hand-eye coordination and manual dexterity in using the tools required for fabrication of the simulator, and in transmission of the messages.

7) Safety and Health: Assure the safe use of hand tools, band saw and drill press; use of proper eye protection. Use of proper attire in a laboratory setting. Establish procedures for clean-up. Discuss how rapid communication, such as the type made possible through fiber-optics, can help alert people of impending emergencies and saves lives.

8) Career Related: Students will participate in activity related to the fields of industrial design, model-making, prototype construction, and communications. Students will also view the job of a technology teacher.

9) Creative Problem-Solving: Opportunities are provided through the construction of the student's own message-sending code, and in construction of the simulator, involving use of tools and material.

10) Transfer of Learning: Use of encoding to transmit messages via other mediums. Application of problem-solving techniques encountered in construction and use of the simulator to other technological problems.

F. Evaluation Techniques

1) Grade students individually, in terms of their accuracy in encoding and decoding messages transmitted on the simulator.

2) Have students research and report (written or oral) on the principles involved in the use of light in fiber-optic communication.

3) Have students research and report (written or oral) on the development and uses of fiber-optic cable.

4) Have students research and report (written or oral) on the advantages/disadvantages of fiber-optic cable, in comparison to wire lines.

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TECHNOLOGY LEARNING ACTIVITY #5

ASSEMBLE AND USE A TELEGRAPH SYSTEM

A. Overview

This activity concerns itself with the telegraph and the idea of electronic communication. First made practical by American university professor Samuel F. B. Morse in the mid-nineteenth century (Kranzberg & Pursell, 1967), the telegraph became the first electrical communication system, and the first to allow communication beyond the limited ranges of voice and vision (Buban, Schmitt & Carter, 1987). It is difficult today to understand the impact of this invention. Until the advent of the Morse telegraph, and its code, the progress and speed of communication technology was almost solely dependent on advances in transportation technology (Galey, 1988). The telegraph had the revolutionary effect on communication of being able to bridge great distances, nearly instantaneously, without the cumbersome requirement of transporting some kind of physical medium to convey the message. In doing so, the telegraph served as a virtual springboard for the electronic communications explosion of the twentieth century.

In this activity, students will construct a traditional telegraphy device, in order to demonstrate one method of electronic communication. Students will be asked to transmit a message over the system, to experience a way in which coded messages are conveyed by means of an electric pulse.

B. Major Concerns to be Addressed

1) Electricity can be used to transmit signals.
2) Signals can be organized into codes, in order to effect communication.
3) Electricity can be channeled and directed.

C. Equipment and Supplies

1) Wood, for base. ½" x 2" x 5½".
2) 15' No. 22 magnet wire.
3) One piece of 20-gauge sheet iron.
4) One large, soft iron spike nail.
5) One ¼" washer.
6) Small piece of 3/4" dowel rod for key.
7) Three 3/8" No. 5 R.H. screws.
8) Two 1" No. 6 F.H. screws.
9) Two 1" stove bolts, size 1/8", with two nuts each, for binding posts.
10) One sheet of drawing paper.
11) One roll of electrical tape.
12) Hand tools (hammer, screwdriver, saw, drill, bits, vise).
13) Glue.
14) Paint, or stain, for wood.
15) One battery.
16) Safety equipment.

(Collings, 1941)

D. Procedure

1) Construct the telegraph set

a) Make the base

b) Sand and prepare the base for a suitable finish.

c) Cut the spike nail, to be used for the magnet coil core. The core of any coil should be made of soft iron, in order to magnetize and demagnetize instantly upon start or stop of current through the surrounding coil of wire. The diameter of this core should be 3/16" to 5/16". Cut the core to the dimension shown in the diagram, and wrap with electrical tape as insulation

For insulation at either end of the coil, paper washers can be made by gluing together several pieces of drawing paper, drilling holes to the diameter of the spike used for the core, and sliding the washers over the core.

d) Drill a hole in the base and mount the magnet core.

e) Wind the coil. Care must be taken to keep it wound tightly and to prevent breaking the insulation on the wire. Start winding at the end where the core is fastened to the base, winding out to the end of the core and back again. The wire should be pulled tightly, with the turns pressed firmly against one another; this is continued until the coil is completed.

Allow about three inches of wire on each end for the necessary connections.

f) Make key and armature supports.

g) Make vibrating armature spring.

h) Solder washer to armature spring.

i) Mount armature support.

j) Mount armature and armature spring (mount the armature spring so that the washer will be about 1/8" above the magnet core).

k) Make key.

l) Make dowel rod for key.

m) Mount key support.

n) Mount key.

o) Mount dowel rod on key with 3/8" R.H. screw.

p) Make contact bracket.

q) Mount contact bracket.

r) Mount binding posts

s) Wire up set.

t) Apply a suitable finish (Collings, 1941).

2) Wire and connect the telegraph set

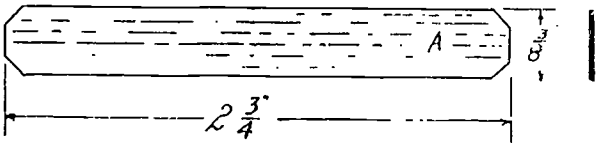
a) Connect one end of coil wire to binding post #1 as shown on diagram to follow.

b) Connect the remaining end of coil wire to the key marked as A, at the point indicated by 2 on the diagram that follows.

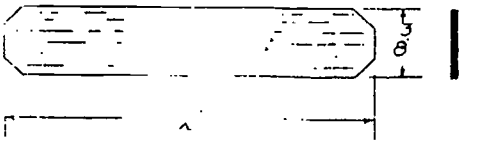
c) Binding post # 4 is connected to the contact bracket # 3, as marked on diagram that follows.

d) The battery is connected by means of wire to binding posts # 1 and # 4, as shown on diagram to follow.

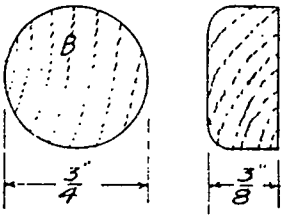
(Collings, 1941)



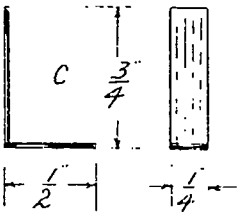
Key 20 gauge iron



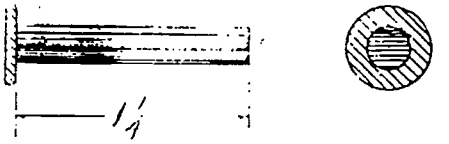
Vibrating armature 20 gauge iron



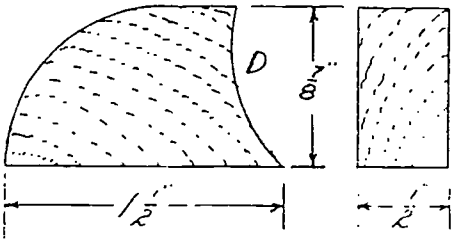
Dowel rod for key



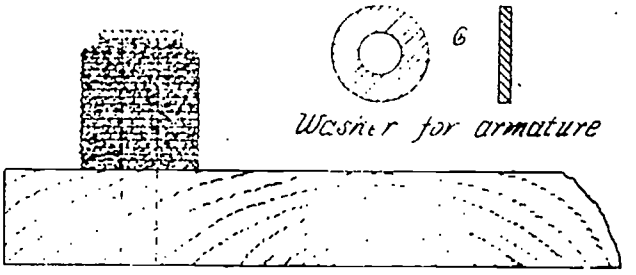
Contact bracket
20 gauge iron



Spike nail Core for coil

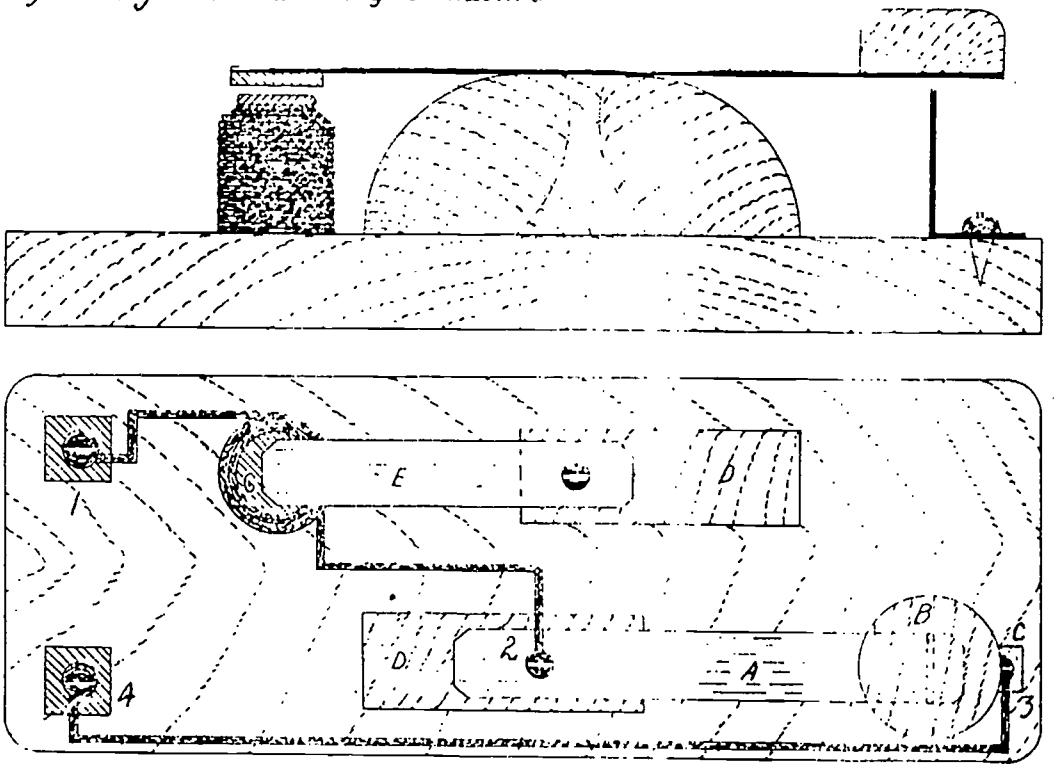


Support for key and vibrating armature



Washer for armature

Magnetic coil



(Collings, 1941)

3) Send a coded message over the system

The electric circuit for the telegraph set consists of a battery, a key, a line and a receiver. The battery is the energy source, and the hand-operated key acts as a switch to open and close the circuit, causing the pulses of current to move through the circuit. The operator controls the pulses by varying the lengths of time the key is switched on, or off. The transmitting and encoding processes are accomplished simultaneously when the operator's hand first closes the key, completing the circuit. The electric pulse ends when the key is released, opening the circuit. A short pulse is called a dot, a long pulse a dash. The dot is about ¼-second long, the dash about three times longer. The dots and dashes of code are carried in the form of electricity by wires, almost instantly, from transmitter to receiver.

The receiver device, called a sounder, makes an audible clicking noise. It has the electromagnet and movable arm; when a pulse of electric current is sent through the electromagnet, it attracts the movable arm, and the resultant connection of the two makes a click. When the electric pulse stops, the movable arm springs back to its original position.

The time between clicks represents a dot or dash. These dots and dashes can represent the

alphanumeric characters of the Morse code, and thus be interpreted as a message by the brain (Buban, Schmitt & Carter, 1987).

a) Have students write a short, one-sentence message.

b) Students then translate the message into Morse code.

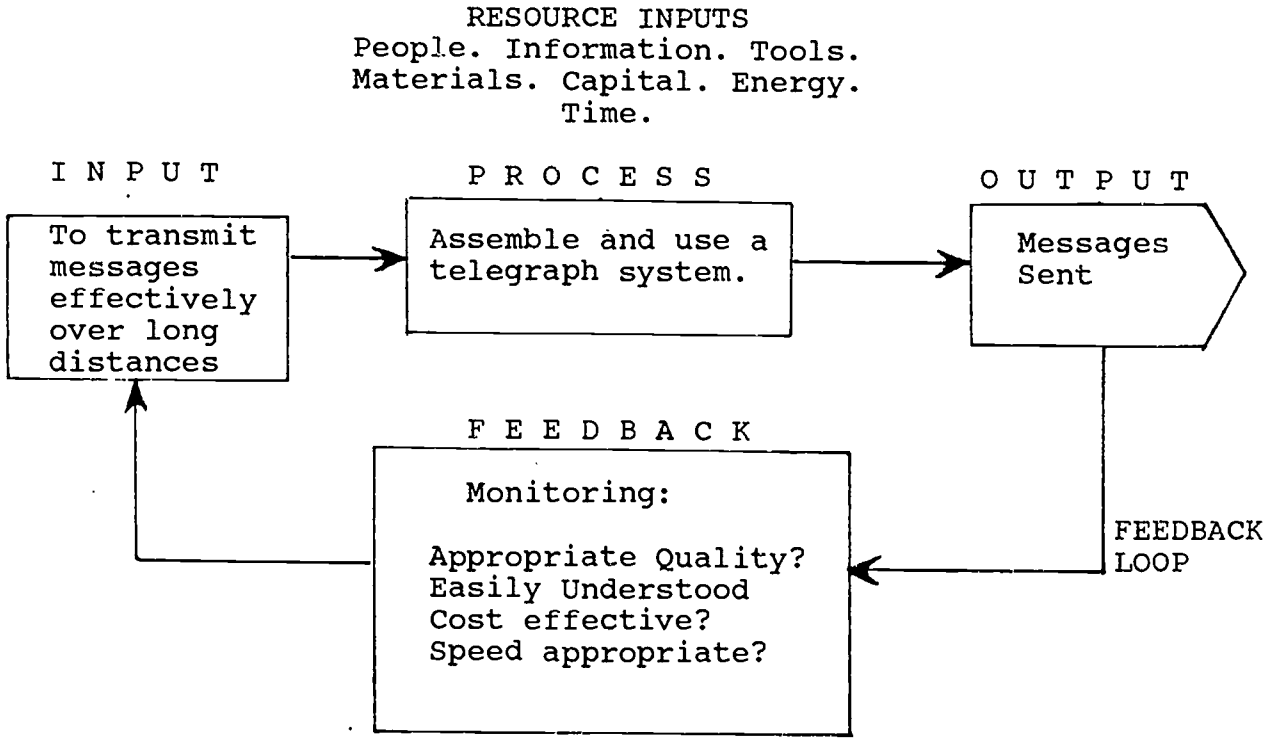
c) Each student must then send their coded message over the telegraph system.

d) Each student must receive another student's encoded message over the telegraph system and decode it to yield a message.

(Kellum & Murray, 1991)

E. Interdisciplinary Aspects of the Activity

1) System of Technology



Identify the role of the following resources in the system of technology model: People, Information, Tools, Materials, Capital, Energy and Time.

(University of the State of NY [UNY], 1988)

2) Math: Consider the use of number codes for sending messages. Binary systems, in electronic communications. Compare methods of transmission of messages as to distance, cost and speed; prepare charts or graphs to display findings. Use of addition, multiplication and division in setting out dimensions for construction of the telegraph system.

3) Science: Discuss the laws of physics concerning electricity (e.g., Ohm's law, Lenz's law). Laws of magnetism. Speed of communication with electricity, versus other mediums. Electrical conductivity of various materials.

4) English: Writing clear and grammatically correct messages for transmission; accuracy and spelling in de-coding. Oral use of technical vocabulary (UNY, 1988).

5) Social Studies (Human and Social Impacts): Discuss the impact of instantaneous communication on the quality of life (e.g., Has it made news events worldwide too immediate? Has it saved lives? Has it made life intolerably complex?). Discuss the importance of the telegraph as a military device during the civil war, and subsequently in uniting the country during westward expansion.

6) Psychomotor Skills: Students will develop or improve hand-eye coordination and manual dexterity in construction of the telegraph system; writing or keyboarding messages; and in keying and decoding messages sent over the telegraph system.

7) Safety and Health: Discuss the potential physical hazards of electricity. Assure the safe use of hand and machine tools. Use of proper eye protection and proper attire in a laboratory setting. Establish procedures for clean-up. Discuss how rapid communication, such as the type made possible by the telegraph, can alert people of impending emergencies and save lives (UNY, 1988) (e.g., railroads and the advent of the telegraph, as a traffic control monitor).

8) Career Related: Students will engage in activities related to careers in the fields of electronics, communications, model making and prototype construction. Students will view the job of a technology education instructor.

9) Creative Problem-Solving: Opportunities are provided to students through the construction and use of the telegraph system; in wiring the system; and in coding/ de-coding messages sent through the system.

10) Transfer of Learning: Application of problem-solving techniques encountered in construction and use of the telegraph system to other technological problems (UNY, 1988). The use of encoding to transmit messages via other communication mediums.

F. Evaluation Techniques

1) Construct and administer a test requiring students to identify and describe the components of the telegraph system.

2) Break the class into teams of two students each. As homework, have the teams study and practice the use of Morse code, over the telegraph system. On the following week, have all the teams compete in trial, each team sending and receiving the same standard set of messages; grade accordingly in terms of accuracy and speed.

3) Have students research and report (oral or written) on the role of the telegraph during the Civil War.

4) Samuel Finley Breese Morse was a colorful, eccentric, American intellectual -- a professor of Fine Arts at New York University, an accomplished portrait and landscape painter, and one of the first U. S. practitioners of photography. Have students research and report (written or oral) on his life and times, particularly regarding his telegraph and code system.

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TECHNOLOGY LEARNING ACTIVITY #6

RADIO COMMUNICATION

A. Overview

The advent of radio in the early part of this century is one of the most remarkable occurrences of the time, and certainly the most revolutionary incident in communication technology history since the telegraph. Radio made it possible to communicate not only with instantaneous speed, but also without installing wire as a message channel. This fact allowed for communication in situations where laying cable or stringing wire was impossible or infeasible. Radio was also the first communication medium to fully exploit the electromagnetic spectrum as a resource, using it as a means to carry a message quickly and economically over vast distances (Aitken, 1976).

In this activity, students will assemble a basic radio transmitter and send a message over a short distance. In doing so, students will learn the basic components of a radio communication system, and observe firsthand how this type of communication is accomplished.

B. Major Concerns to be Addressed

1) Sound waves can be used to transmit messages.
2) Communication systems can involve alternating forms of energy in transmission of a message.

3) Communication devices are constructed of various materials and consume energy in production and use (Hayden, 1986).

C. Equipment and Supplies

1) Small portable AM radio.
2) RF signal generator.
3) AF generator.
4) Oscilloscope.
5) Cassette recorder/player, with output jack.
6) 10 feet (304.8 mm) no. 18--no. 22 copper antenna wire.
7) Cassette tapes (blank).
8) Connector and cable for RF generator output.
9) 2 feet (60.9 mm) two-conductor cable, with connectors to match the output jacks of the AF generator on one end, and the audio-input jacks of the RF generator on the other.
10) 2 feet (60.9 mm) two-conductor cable, with connectors to match the auxiliary speaker output of the cassette recorder on one end and the RF generator audio-input connection on the other.
11) Paper and pencils.
12) Solder and iron.

(Buban, Schmitt & Carter, 1987)

D. Procedure

1) Write and record messages for transmission.
   a) Have students write and then record on cassette tape a brief essay for transmission over the radio

system. This message must carry information on a topic related to radio communication (e.g., technical description of a component of the system, brief history of the development of radio, uses of radio communication today).

b) Students must submit their finished essays to the instructor for approval before recording on cassette.

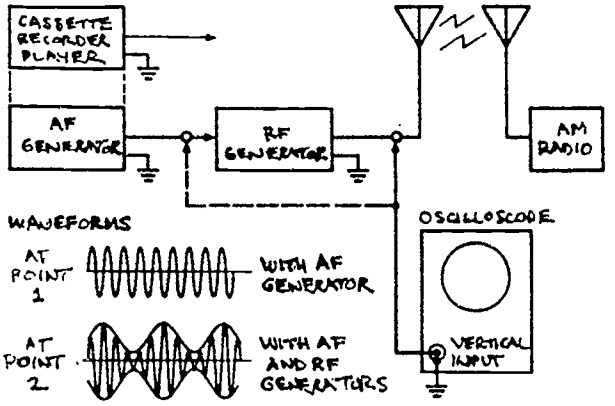
2) Assemble and test the radio communication system.

a) Solder the antenna wire to the center connection of the connector compatible with the RF generator output. This wire will act as a transmitting antenna. Connect the antenna to the center terminal of the RF output jack on the RF generator.

b) Using the test leads of the Oscilloscope, connect the antenna wire to the vertical input terminal of the oscilloscope. The common ground lead of the oscilloscope is connected to the common ground on the RF generator. This oscilloscope will let students observe the waveform being transmitted to the radio.

c) Connect the output of the AF generator to the audio input of the RF generator, and set the RF generator selector switch to the "external modulation" setting.

d) Coil the antenna wire in a loose circle about one foot (30.48 mm) in diameter, and place it on the work surface. Set the AM radio near the coil.



e) Turn on the oscilloscope, RF generator, AF generator and the AM radio.

f) Set the AF generator for 500 Hz and observe the waveform at point 1 (see diagram) on the oscilloscope.

g) Tune the AM radio to a frequency that is not used locally.

h) Set the frequency range selector of the RF generator to the AM band position (535 to 1605 kHz). Sweep through this band, adjusting the tuning control knob on the RF generator, until a tone is heard on the radio.

i) Observe the oscilloscope, adjusting the output level of the RF generator and the AF generator to get a pattern that closely resembles that shown at point 2 (see diagram above).

j) Once finding an acceptable tone in the radio, sweep through the range of the AF generator, and observe the changes in the waveform on the oscilloscope. Listen to the various tones in the radio.

NOTE: Equipment used in this activity may cause interference to radio and television reception in the area. If so, turn off the equipment and set the power level of the RF generator to the minimum needed to observe the signal on the oscilloscope. Try to eliminate the interference by re-orienting the antenna or relocating the equipment.

3) Transmit the recorded messages.

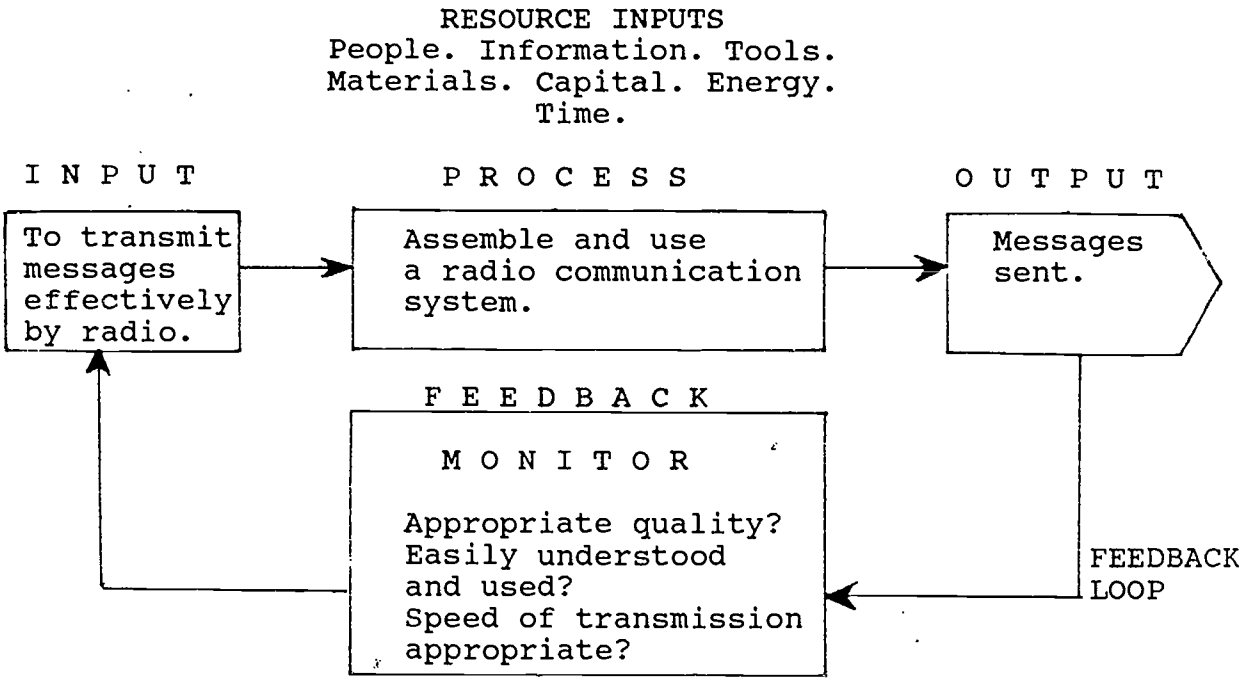
   a) Replace the AF generator with the cassette recorder/player, using the cable compatible with both the cassette player and the RF generator. Put in the cassette carrying the student-recorded message, and press the PLAY button on the cassette recorder/player. Adjust the volume control until the pattern shown on the oscilloscope matches that observed when there was an acceptable tone from the audio generator. Notice how the audio pattern on the carrier wave matches what is heard on the AM radio.

   b) Have students draw on paper the oscilloscope waveform observed when the cassette recorder is connected in step (a) above. Discuss this drawing with the class (Buban, Schmitt & Carter, 1987).

   c) Discuss with the class personal feelings and experiences regarding this activity (Hayden, 1986).

E. Interdisciplinary Aspects of the Activity

1) System of Technology:



Identify the role of the following resources in the system above: People, Information, Materials, Tools/Machines, Capital, Energy and Time.

(University of the State of New York [UNY], 1988)

2) Math: Compare the speed of transmission of messages by radio wave with that of other mediums; prepare charts or graphs to display findings. Incidental use of addition, subtraction, multiplication and division in constructing the radio communication system. Calculation of wavelength through use of the formula $\lambda = \frac{c}{f}$, where λ is the wavelength in meters, c is the speed of wave propagation in space in meters per second, and f is the frequency expressed in Hertz (Morecraft, 1921).

3) Science: Discuss the laws of physics concerning electricity: Ohm's law, Lenz's law. Discuss electromagnetic wavelength theory, and the properties of radio waves: frequency, wavelength, radiation, directivity, propagation. Wave modulation: amplitude modulation (AM) and frequency modulation (FM). Characteristics of radio antennas. Use of radio in astronomy (radio telescopes) (Dorbuck, 1978).

4) English: Writing clear and grammatically correct messages for transmission over the system. Accuracy in spelling and punctuation. Oral use of technical vocabulary (UNY, 1988).

5) Social Studies (Human and Social Impacts): Radio transmissions can be blocked, but only with greater difficulty than communication through a physical medium or channel; discuss with the class the phenomenon of radio propaganda (e.g., Radio Free Europe, "Tokyo Rose", Radio Moscow). In this country, the Federal Communications Commission (FCC) controls and grants license to use all types of radio communication; discuss with the class the role of the FCC, or debate the requirement of federal regulation for radio use.

6) Psychomotor Skills: Students will develop or improve eye-hand coordination and manual dexterity in writing or key-boarding messages for transmission over the radio communication system, in assembling and using that system, and in drawing wave patterns observed on the oscilloscope.

7) Safety and Health: Discuss the potential physical hazards of electricity. Assure the safe use of hand tools. Use of proper eye protection and proper attire in a laboratory setting. Establish procedures for clean-up. Discuss how rapid communication, such as the type made possible by radio, can alert people of impending emergencies and save lives (UNY, 1988). Radio was the first medium to make communications possible with people in transit, regardless of distance or meteorological conditions; discuss with the class the impact of radio communications on air and sea travel safety.

8) Career Related: Students will engage in activities related to careers in the fields of electronics, engineering, broadcasting and journalism. Students will also observe the job of the technology education teacher.

9) Creative Problem-Solving: Opportunities are provided to students through the construction and use of the radio communication system, and in writing the short essay required as a message for transmission over the system.

10) Transfer of Learning: Application of problem-solving techniques encountered in the construction and use of the radio communication system to other technical problems (UNY, 1988), particularly regarding the use of an oscilloscope, construction of antennas, and soldering technique.

F. Evaluation Techniques

1) Have individual students record on cassette tape as many widely-varied sounds as possible (e.g., bell, car horn, sneezing, violin). Observe wave patterns for these collected sounds as displayed on the oscilloscope, and record the patterns on paper. Discuss with the class the outcome of the exercise. Have the students create a poster-board display (individually, or in groups) to exhibit their findings.
2) Create and administer a test requiring students to identify and describe the components of the radio communication system, as constructed for the activity.
3) Have individual students locate and interview a radio technician, then report back to the class in a brief oral presentation.
4) Have students maintain a daily log-book of their use of radio, in any form, over the period of one week. Students must then draw conclusions from their recorded data and report findings to the class in a brief oral presentation.
5) Have individual students research and report (written or oral) on one of the following topics: (a) radio waves and frequency; (b) Guglielmo Marconi and his invention of wireless telegraphy; (c) the founding of radio station KDKA-Pittsburgh; (d) the creation of the Federal Communications Commission (FCC).
6) Observe student participation in activities during class.

7) Evaluate listening, reading and viewing habits of individual students during class.

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TECHNOLOGY LEARNING ACTIVITY #7

SATELLITE COMMUNICATION

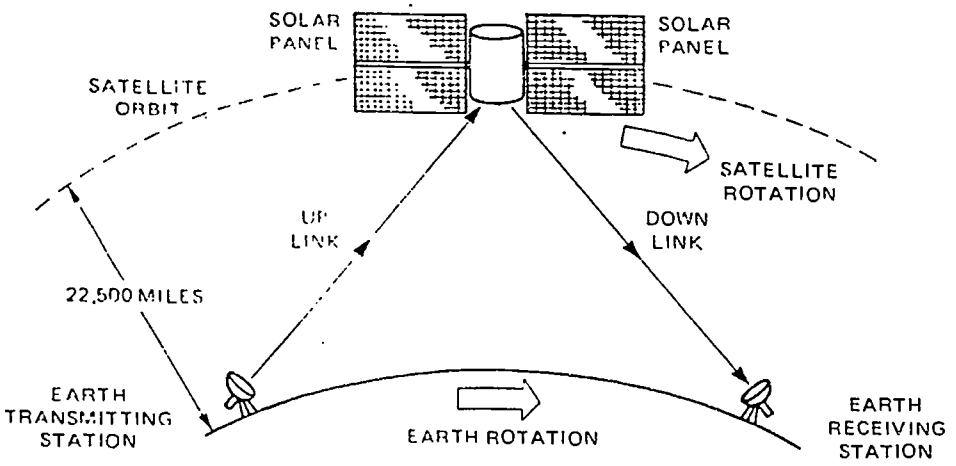
A. Overview

Electricity and electronics have revolutionized communications technology, making it both instantaneous and pervasive. The telegraph system was the first to send messages over wire. Later, the telephone made it possible to communicate by voice. Early in this century, the first code and voice signals were sent through the air by radio, whereby information was sent over distance from a transmitting antenna to a receiving antenna.

Today, satellite communication systems bring us information. They allow us to see sports and other events taking place across the globe. Communication satellites also transmit cable television shows around the country and make it possible for the newspaper, USA Today, to be printed five days a week in 32 printing plants worldwide.

These man-made communication satellites act as repeaters, picking up broadcast signals from various points on earth and re-broadcasting them to other distant points on earth. Communication satellites are placed in geo-synchronous orbit 22,500 miles above earth so that the satellite travels at the same speed as the earth in rotation. The satellite therefore appears to stay locked in the same place in the sky. The signal from the earth transmitting station is called the "up-link" and

the transmission from the satellite to the earth receiving station is called the "down-link". Some communication satellites in use today can handle in excess of 10,000 telephone conversations and a dozen color television transmissions simultaneously (Harms, 1988).



The satellite travels at about the same speed as the Earth's rotation

In this activity, students will set-up and use a model satellite system that uses a light beam to carry messages. Transistors and integrated circuits change sound to electricity at the transmitter, and change light back to sound at the receiver (Harms, 1988). Students will also be presented with the requirement to transmit a message over a distance using the system (University of the State of New York [UNY], 1988).

B. Major Concerns to be Addressed

1) The solutions to practical problems often involve a combination of sub-systems from different aspects of technology (UNY, 1988).
2) Light waves can be used to transmit signals.
3) Light waves can be channeled and directed.
4) Communication systems can involve alternating forms of energy in transmission: sound wave/electric pulse/light wave.
5) Man-made satellites can be used to repeat and transmit many kinds of information, over vast distances.

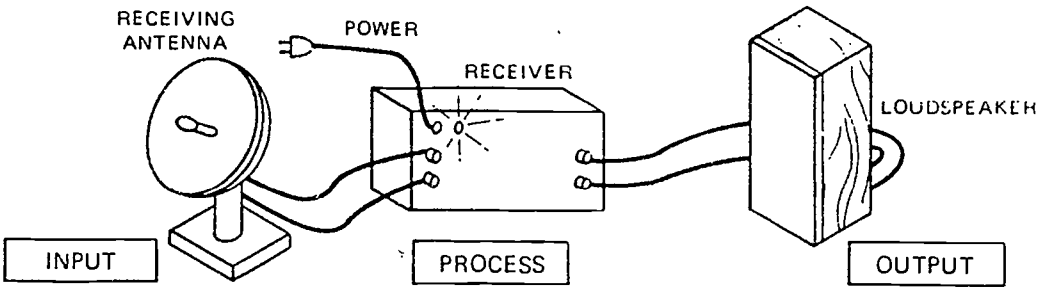
C. Equipment and Supplies

1) CES Transmitter Station.
2) CES Receiver Station.
3) CES Satellite Station.
4) Cassette recorder with built-in microphone.
5) Pre-recorded and blank cassette tapes.
6) Assorted materials, to construct a satellite station "housing" (wood, metal, plastic, hand-tools, nails, screws, etc.).

(Harms, 1988)

D. Procedure

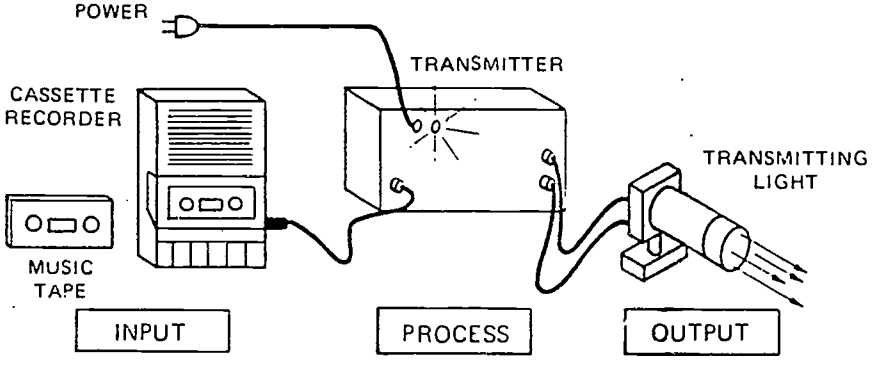
1) Set up the receiver station. Connect the receiver assembly station parts as shown:



Receiver station components and connection diagram

(Harms, 1988)

2) Set up the transmitter station as shown below:



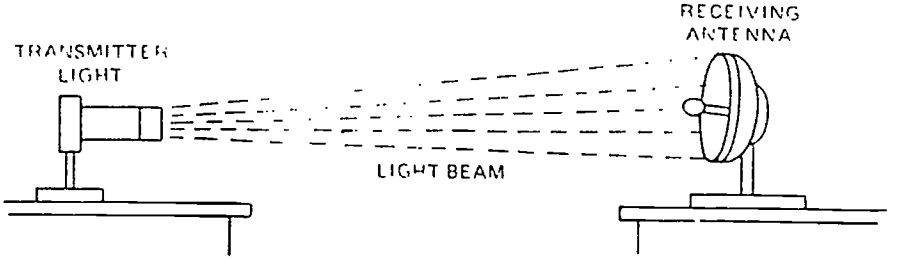
Transmitter station components and connection diagram

a) Use a bench top that is the same height as the receiver station and approximately eight feet away. Make sure that the wire from the transmitter circuit card is plugged into the jack on the cassette player marked EXTERNAL SPEAKER.

b) To check the set up, place the pre-recorded tape in the cassette player, press the PLAY button, and insert the jack. You should no longer hear music from the cassette player speaker. Leave the plug in place.

c) Turn on the power from the receiver and the transmitter. Play the music tape and aim the transmitting light at the receiving antenna.

d) Adjust the positions of the transmitter light and the receiving antenna for the loudest possible sound, and then focus the transmitter light (by rotating the lens assembly) to get the narrowest light beam possible (Harms, 1988).



3) Prepare a message tape.

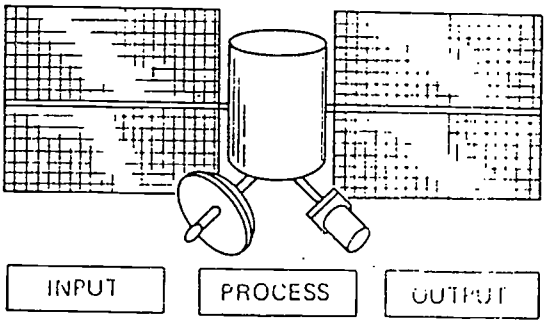
a) Students will prepare a message tape to demonstrate the complete satellite system. Students select a topic, and have it approved by the instructor; possible topics might include a newscast describing school events, a welcome message for visitors to the classroom, or a short description of satellite

communications. Students will write a script for a two-minute message, and record it on a blank tape using the cassette recorder and microphone.

b) Students must have script approval from the instructor before recording on tape (Harms, 1988).

4) Building the satellite housing.

The CES satellite is made of three separate parts: the circuit board, the receiving antenna, and the transmitting light. In a real satellite, all of these parts would be housed in one container.

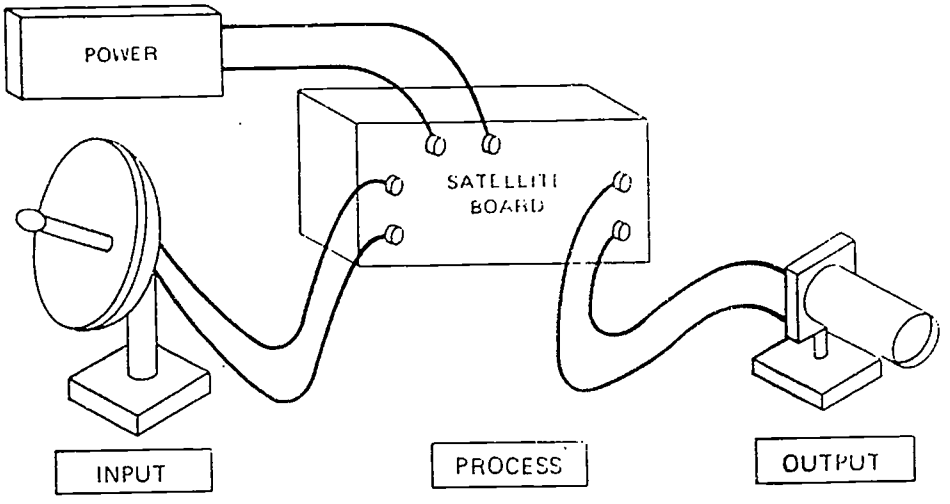


Satellite contained in a cylinder

Students must find reference materials to determine what several communication satellites look like. Have the students sketch possible designs and then construct a housing so that the satellite can be located a a high point in the classroom, and used to relay the transmitter message to the receiver. Make sure that students use only the supplies, tools and machines permitted by the instructor (Harms, 1988).

5) Set up the satellite system.

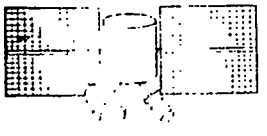
a) Set up the CES satellite system as shown in the diagram below:



Satellite station components and connection diagram

b) Have the students mount their finished satellite housing constructions at high locations within the classroom. Make sure that this is done with the involvement of the instructor.

c) Position the transmitter, satellite and receiving stations as shown below:



Satellite system unit locations

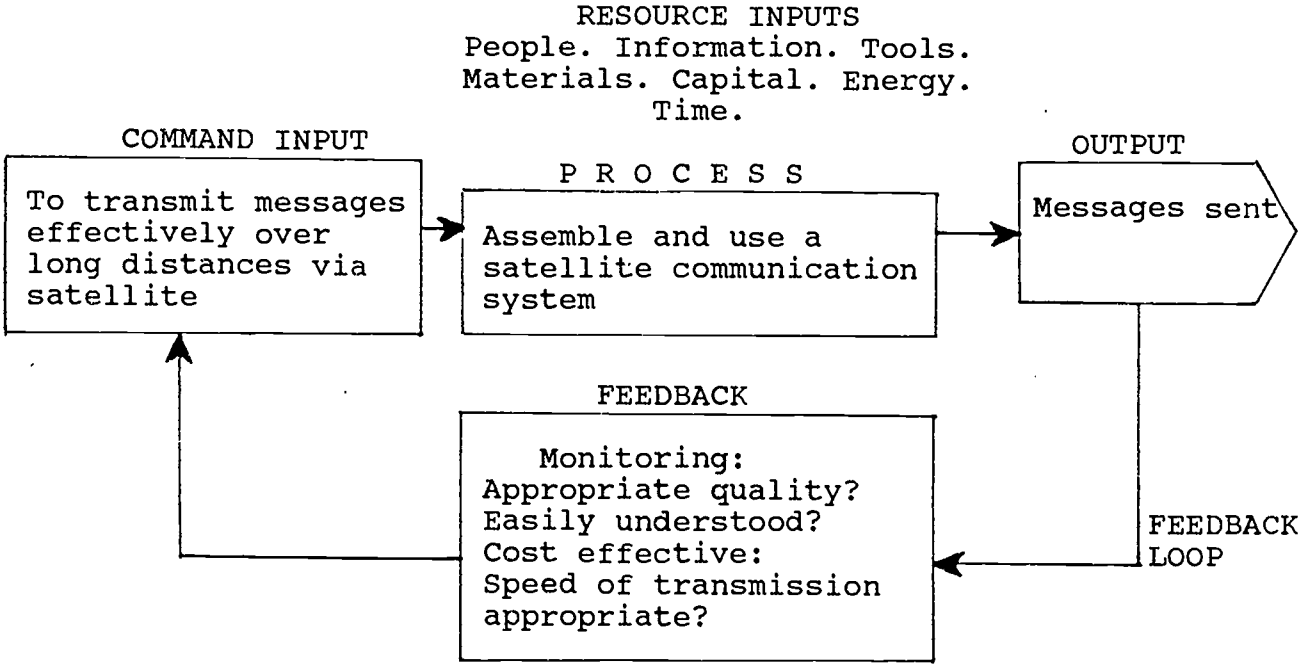
d) Align the transmitter light, and the optical receiver link.

e) Leave the satellite in this position, and align the satellite transmitter and receiver down-link. Test and adjust the system, using a pre-recorded music tape.

f) Have students demonstrate the system themselves by using their individual message tapes (Harms, 1988).

E. Interdisciplinary Aspects of the Activity

1) System of Technology:



Identify the role of the following resources in the system above: People, Information, Tools, Materials, Capital, Energy and Time (UNY, 1988).

2) Math: Compare methods of transmission of messages as to distance, cost, and speed. Develop charts and graphs to present findings. Compare baud rates, for transmission. Use trigonometric functions to calculate location of transmitter, satellite or receiver (UNY, 1988). Use of addition, division and multiplication in setting dimensions for construction of the satellite housing.

3) Science: Geostationary orbits. Design and construction of the satellites and launch vehicles. Electronics. Use of satellites for: communication, military use, weather forecasting, and detecting pollution. Energy conversion. Strategic Defense Initiative. Speed of communication with light, versus other mediums (UNY, 1988).

4) English: Writing clear, grammatically correct scripts/messages for transmission. Written and oral use of technical vocabulary (UNY, 1988).

5) Social Studies: (Human and Social Impacts): Discuss how the communication satellite has helped make our world a global village. Faster communications affect the relationships between people. Consumer use of receiver dishes as television antenna, versus cable (UNY, 1988).

6) Psychomotor Skills: Students will develop or improve hand-eye coordination and manual dexterity in using the tools required for manufacture of the CES satellite housing; in putting together and positioning the various

components of the CES satellite system; and in writing or perhaps keyboarding the script/message for transmission.

7) Safety and Health: Assure the safe use of hand-tools and electronic equipment. Use of proper eye protection and proper attire in a laboratory setting. Establish procedures for clean-up. Discuss how rapid communication, such as the type presented by satellite communications, can alert people of impending emergencies and save lives (UNY, 1988). Discuss how worldwide satellite transmission of advances in medicine can save lives.

8) Career Related: Students will engage in activities related to careers in the fields of electronics, communications, creative writing, engineering, journalism, and technical support (UNY, 1988). Students will also view the job of a technology teacher.

9) Creative Problem-Solving: Opportunities are provided through the construction of the satellite housing, positioning of satellite system components within the classroom, and in writing the script or message required for transmission over the satellite system.

10) Transfer of Learning: Application of problem-solving techniques, such as the combination of various aspects of technology, or the conversion of energy, in designing systems to solve other technological problems (UNY, 1988).

F. Evaluation Techniques

1) Construct and administer a test requiring students to identify and describe the major components of a satellite communications system.
2) Have students research and report (written or oral) on the evolution and impact of satellite communication systems (UNY, 1988).
3) Grade students individually in terms of their success and effort in constructing scripts or messages for transmission over the CES satellite system.
4) Have students research and report (written or oral) on the many uses of satellite systems (e.g., communications, security, surveillance, manufacturing, scientific data) (UNY, 1988).
5) Grade students individually in terms of their success and effort in constructing a satellite housing for the CES satellite system.
6) Have students research and report (written or oral) on how satellite communication technology has helped to make the world a global village (UNY, 1988).

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TECHNOLOGY LEARNING ACTIVITY #8

INTRODUCTION TO THE LASER

A. Overview

The first laser was created over 30 years ago, and grew out of experimentation with microwave amplification devices called masers. Maser stands for "microwave amplification by stimulated emission of radiation". Similarly, laser stands for "light amplification by stimulated emission of radiation" (Harms, 1988).

Since its invention, the laser beam has been an important tool. New applications for lasers are developed every day, and the potential of laser applications appears truly infinite. Among its already wide variety of uses is the transmission of information and data. Through use of a laser beam, an office in Manhattan will be able to deliver to an office in Los Angeles the information equivalent to an entire 30-volume set of encyclopedias, in something less than 1/10th of a second. Not since the invention of the computer has there been a device with such potential to change the way we live, learn and communicate (Kitzman, 1988).

In this activity, students will set up a model communication system, employing a laser as a channel, in order to demonstrate this form of electronic communication. Students will then be asked to transmit a coded message over the system, to experience a way in which communication can be effected by laser light.

B. Major Concerns to be Addressed

1) Lasers can be used to transmit signals.
2) Signals can be organized into codes, in order to effect communication.
3) Lasers can be channeled and directed.

C. Equipment and Supplies

1) Class II Helium/Neon modulated laser.
2) One piece white cardboard, approximately 5′ x 5′.
3) Four acrylic or glass mirrors, approximately 4" x 4".
4) One sheet 3/4" plywood.
5) One ½" diameter steel rod, approximately 8" in length.
6) One tube of contact cement.
7) Pencils and writing paper.
8) One yardstick.
9) One protractor.
10) Hand tools (e.g., saw, drill, ½" bit, hammer, vise).

(Rutherford & Hester, 1993)

D. Procedure

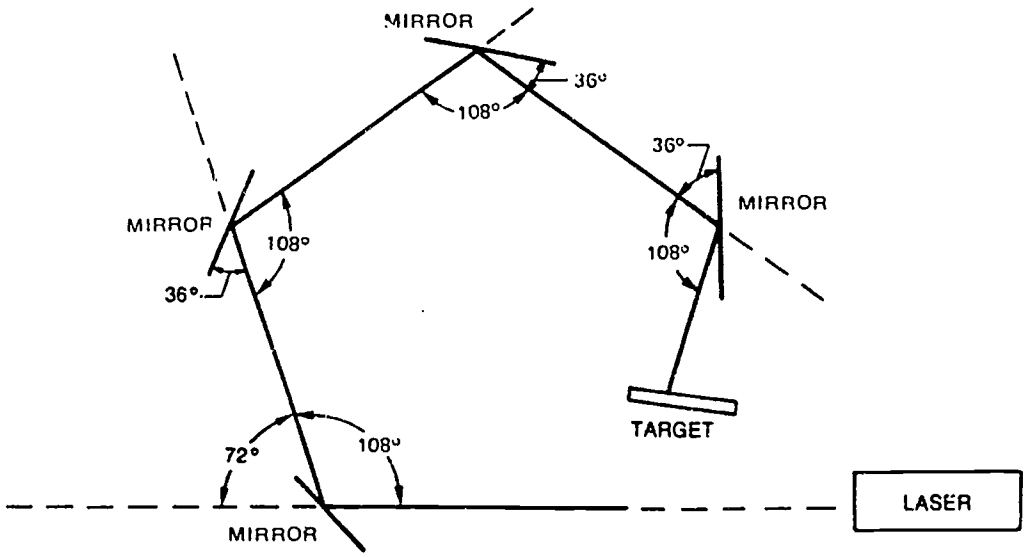
1) Construct the laser system:
   a) Put on safety glasses.
   b) Obtain permission from the instructor before operating equipment.
   c) Cut four mirrors and five 3/4" plywood panels to dimensions of 4" x 4".
   d) Mount the four 4" x 4" mirrors onto one side of four 4" x 4" plywood panels, using contact cement.

e) Drill one ½" diameter hole, 1½" deep, in the edge and near the back of each of five plywood pieces.

f) Cut a ½" diameter steel rod into five-1½" lengths. Fit the rod into the hole drilled into each of the five plywood pieces. This will serve to balance each so that it can be placed on edge.

g) Cut one piece of white cardboard to a size of 4" x 4" and mount it with contact cement to one side of the fifth piece of 4" x 4" 3/4" plywood, to create a "target" for the system.

h) Using a pencil, protractor and yardstick, mark out the following layout on the sheet of white cardboard:



(Rutherford & Hester, 1993)

i) Position the mirrors, target and lasers as per the layout. Turn on the laser and test the system. Adjust as required. The laser beam can be interrupted by means of a card, or laser-mounted

shutter, in order to transmit a light-code of "dots" and "dashes".

2) Send a coded message using the laser system:

a) Have students write a short, one-sentence message.

b) Students must translate the message into Morse code.

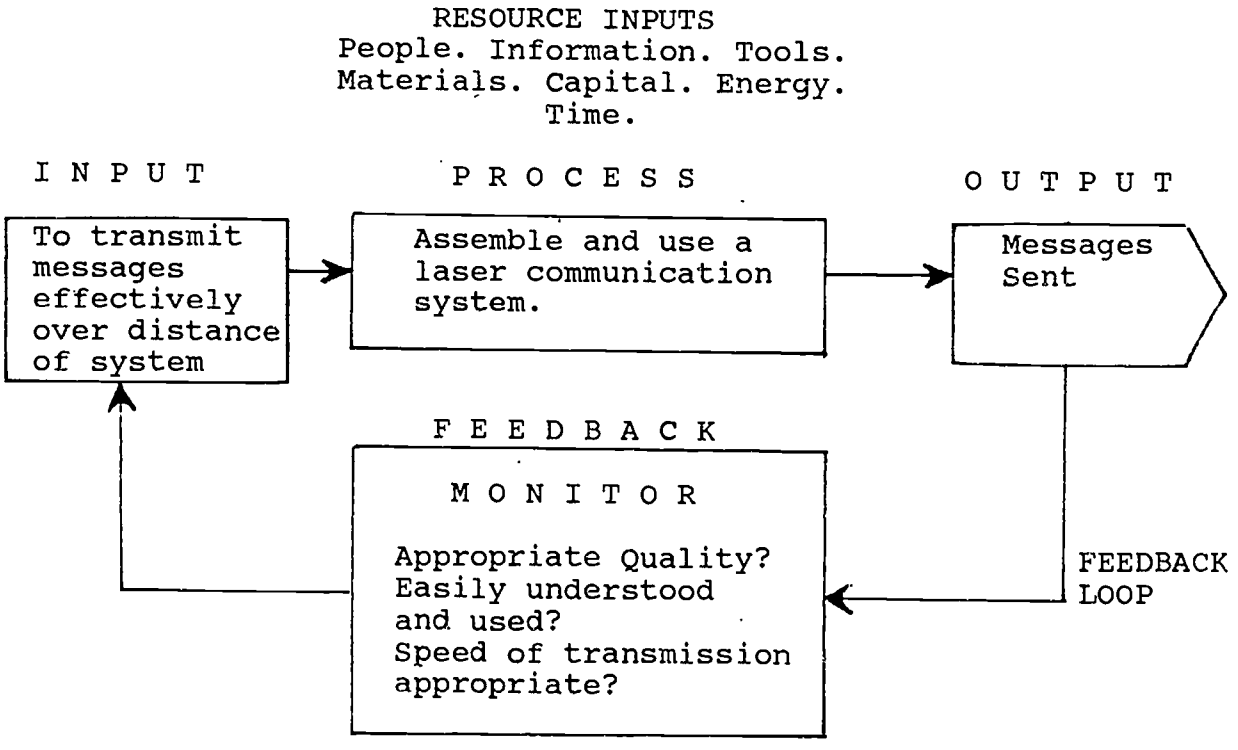
c) Each student must then send their coded message over the laser system.

d) Each student must receive another student's code over the system, and de-code to yield a message.

(Kellum & Murray, 1991)

E. Interdisciplinary Aspects of the Activity

1) System of Technology



Identify the role of the following resources in the system above: People, Information, Materials, Tools, Capital, Energy and Time.

(University of the State of New York [UNY], 1988)

2) Math: Geometric principles employed in constructing layouts for the system, and understanding the laws of physics regarding reflection. Use of number codes, in sending messages. Binary systems, and their use in electronic communication. Compare the speed of transmission via laser with other communication mediums, developing charts and graphs to detail findings. Use of addition, subtraction, multiplication and division in setting out dimensions for construction of the system.

3) Science: Laws of physics concerning reflection. The visible spectrum of light. Energy conversion from electricity to laser light. Discuss the peculiar properties of laser light (e.g., monochromaticity, resistance to divergence, etc.) (Balistreri, 1985). Discuss the four categories of laser power.

4) English: Writing clear and grammatically correct messages for transmission; accuracy and spelling in de-coding. Oral use of technical vocabulary (UNY, 1988).

5) Social Studies (Human and Social Impacts): Discuss the applications of laser light, in medicine, in military science, in video disc readers and supermarket check-out scanning systems. Discuss the impact of instantaneous

communication, such as the type brought about by laser light linked with fiber-optics, on the quality of life.

6) Psychomotor Skills: Students will develop or improve eye-hand coordination and manual dexterity in construction of the laser communication system; and in employing the system, by writing or keyboarding messages for transmission, as well as receiving coded messages.

7) Safety and Health: Discuss the potential physical hazards of laser light, and electronic equipment. Assure the safe use of hand and machine tools. Teach the use of proper eye protection and proper attire and a laboratory setting. Establish procedures for clean-up. Discuss the use of lasers in surgical procedure. Discuss how rapid communication, such as the type made possible by laser light, can alert people of impending emergencies and save lives (UNY, 1988).

8) Career Related: Students will engage in activities related to careers in the fields of electronics, telecommunication, engineering, model-making and prototype construction. Students will view the job of technology education teacher.

9) Creative Problem-Solving: Opportunities are provided to students through the construction of the laser communication system; and in coding and de-coding messages sent through the system.

10) Transfer of Learning: Application of problem-solving techniques encountered in the construction of the Laser

communication system, including geometric construction, to other technical problems (UNY, 1988). The use of encoding to transmit messages via other communication mediums.

F. Evaluation Techniques

1) Break the class into teams of two students each. Have the teams transmit a standard message, in Morse code, using the laser communication system over an expanded distance (e.g., approximately 30'). This expanded course might include a wall or desk "obstacle", that render sender and receiver blind to each other. Grade the teams accordingly, in terms of accuracy and speed of transmission.
2) Have students research and report (oral or written) on the role of lasers in: a) fiber-optic communication, or b) surgical procedure.
3) Construct and administer a test requiring students to identify and describe the components of the laser communication system, and the characteristics of laser light.
4) Have students research and report (written or oral) on the discovery and development of the laser, particularly with regard to its use in communication technology.
5) Have students research and report (written or oral) on their speculation for future applications of laser technology, particularly regarding communication.

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TECHNOLOGY LEARNING ACTIVITY #9

LASER FIBER-OPTIC COMMUNICATION

A. Overview

The most revolutionary impact of the laser on communication technology today is linked with a separate technology concerning thin glass fibers, called fiber-optic cable (Kitzman, 1988). The fiber is made of pure sand (silicon dioxide) and quartz powder, in the form of a tiny, hollow rod. Heated gas is blown through the hollow rod to leave a thin deposit of ultra-pure glass on the inside of the rod. This tube is then heated again and collapsed into a solid rod, with an ultra-pure glass core. These tiny fiber-optic cables enjoy tremendous advantages over the conventional copper-wire cables. The most important advantage is in capacity; when employed as a channel for a modulating laser, they can handle ten times as much information (Woods, Verboys & Evans, 1992). The speed of laser light also makes message transmission through fiber-optic cable much faster than anything experienced before. Fiber-optic cable also prevents laser beam blockage from outside interference, allows for easy transmission around corners, and helps contain the laser beam in order to prevent beam spreading over long distances. This final characteristic of fiber-optic cable allows pulsed energy to travel for a much greater distance without amplification than the conventional copper-wire cable (Kitzman, 1988).

In this activity, students will demonstrate the safe operation of a class II helium-neon laser, as well as demonstrate how a basic fiber-optics telecommunication system works, by transmitting a message of their own construction over such a system.

B. Major Concerns to be Addressed

1) Laser light can be used to transmit signals.
2) Laser light can be channeled and directed.
3) Solutions to practical problems often involve a combination of subsystems from different technologies (University of the State of New York [UNY], 1988).
4) Communication systems can involve alternating forms of energy in transmission of a message.

C. Equipment and Supplies

1) Modulated class II helium-neon laser.
2) Laser receiver.
3) Lengths of fiber-optic cable.
4) Microphone or cassette recorder, with a suitable patchcord to plug into the input jack of the laser unit.
5) Sheet of white paper.

(Harms, 1988)

D. Procedure

1) Introduction to fiber-optic cable.
    a) Have students physically examine a length of fiber optic cable.

b) Have students hold one end of the fiber-optic cable at a bright light, to witness the transmission of light at the opposite end.

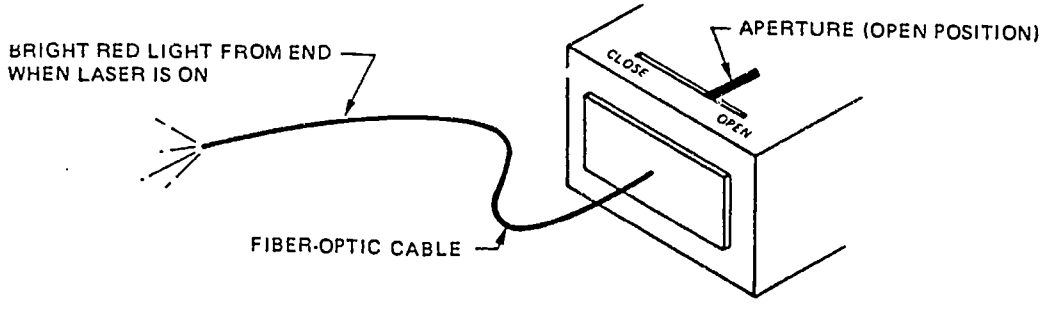
c) Have students point one end of the cable at a light source, bend the cable, and see that the cable still transmits light.

d) Have students hold the ends of two lengths of fiber-optic cable together, in a crude splice, to see that joined cable transmits light.

2) Demonstrate a basic laser fiber-optic system.

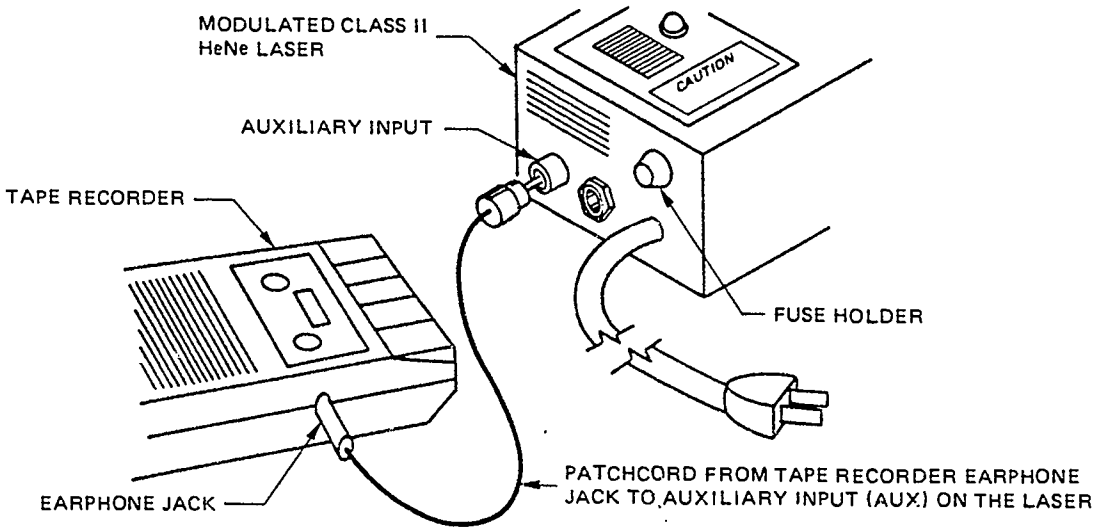
a) Have students compose a brief, two-paragraph description of fiber-optic cable, or the helium-neon laser. This will be used as a message for transmission across the laser fiber-optic system. Students can elect either to speak directly into a microphone, or pre-record on cassette.

b) Connect one end of the fiber-optic cable to the aperture of the laser. Turn on the laser, and open the laser aperture. A bright, red laser light should appear at the end of the fiber-optic cable.



Fiber-optic cable assembly

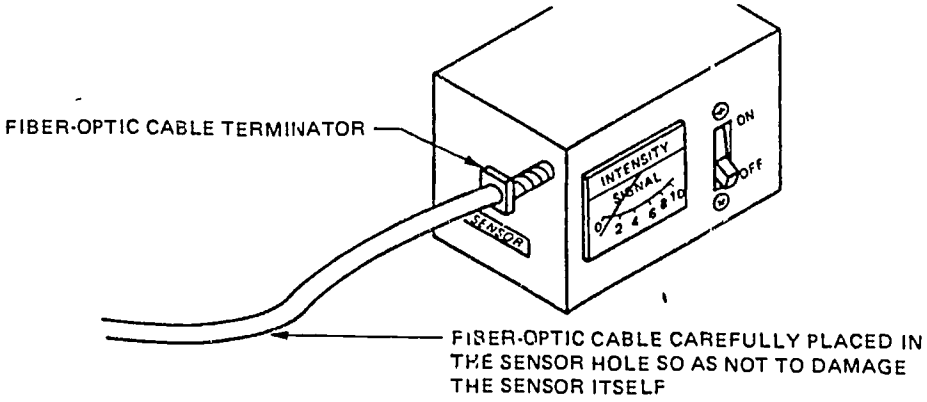
c) Turn off the laser, and plug in the sound source (either a microphone or a cassette player) at the appropriate input jack on the laser.



d) Turn on the laser, and open the laser aperture.

e) Hold the free end of the fiber-optic cable approximately three inches away from a sheet of white paper; speak into the microphone, or play the cassette player. Have students observe that the intensity of the light from the laser varies with the volume of the sound input.

f) Carefully place the free end of the fiber-optic cable into the appropriate jack on the laser receiver; turn on the laser receiver.

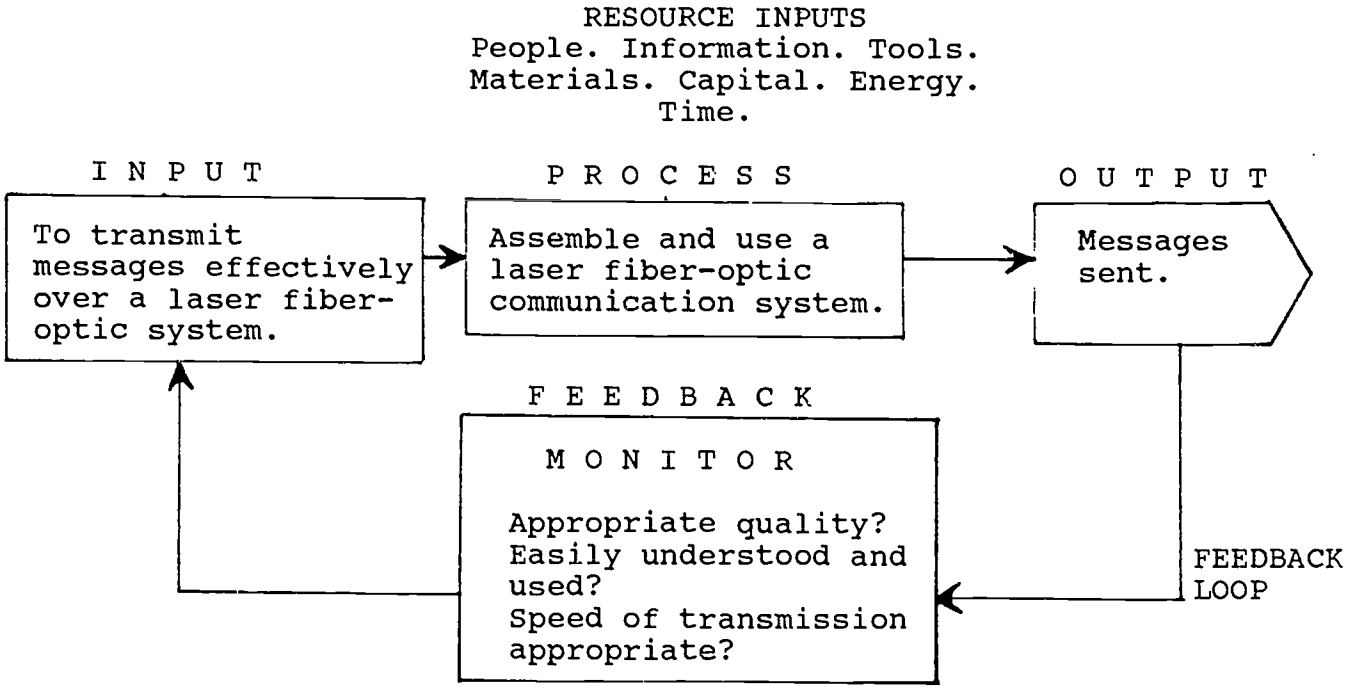


g) Speak into the microphone, or play the cassette player, and have students observe the signal meter on the side of the laser receiver. The signal meter will give a variable reading descriptive of the sound volumes being received.

h) Turn up the volume control on the laser receiver, and hear sound produced in the receiver that is transmitted by means of laser, channeled through fiber-optic cable. Have students transmit their own messages over the system (Harms, 1988).

E. Interdisciplinary Aspects of the Activity

1) System of Technology



Identify the role of the following resources in the system above: People, Information, Materials, Tools/Machines, Capital, Energy and Time.

(UNY, 1988)

2) Math: Compare methods of transmission of messages as to distance, cost and speed (including laser fiber-optic); develop charts and graphs to display findings. Discuss the speed of laser light in relation to the speed of electricity, or sound waves.

3) Science: Discuss the visible section of the electromagnetic spectrum. Energy conversion (e.g., sound waves/electricity/laser). The properties of laser light (e.g., monochromaticity, the four categories of laser power, characteristics regarding divergence, etc.) (Balistreri, 1988). Frequency modulation, which allows multiple and simultaneous messages to travel over cable. The laws of physics concerning light. The composition of fiber-optic cable, versus the previous standard, copper co-axial cable.

4) English: Writing clear and grammatically correct messages for transmission over the system. Accuracy in spelling and punctuation. Oral use of technical vocabulary (UNY, 1988).

5) Social Studies (Human and Social Impacts): Discuss the applications of laser light in medicine; in military science; in construction; in video disc readers and supermarket check-out scanning systems. Consider the impact of instantaneous communication, such as the type brought about by laser fiber-optics, on the quality of life. Discuss the impact of smaller, and fewer communication cables, made possible through the use of fiber-optics.

6) Psychomotor Skills: Students will develop or improve eye-hand coordination and manual dexterity in the construction and use of the laser fiber-optic communication system; and by writing or keyboarding messages for transmission over the system.

7) Safety and Health: Discuss the potential physical hazards of laser light, and electrical equipment. Teach the use of proper eye protection, in a laboratory setting. Establish procedures for clean-up. Discuss the use of lasers in surgical procedure. Discuss how rapid communication, such as the type made possible by laser fiber-optics, can alert people of impending emergencies and save lives (UNY, 1988).

8) Career Related: Students will engage in activities related to careers in the fields of electronics, telecommunications, engineering and broadcasting. Students will also observe the job of technology education teacher.

9) Creative Problem-Solving: Opportunities are provided for students through the construction of the laser fiber-optic system, and in writing appropriate messages for transmission over the system.

10) Transfer of Learning: Application of problem-solving techniques encountered in the construction of the laser fiber-optic system, particularly with regard to the concept of energy conversion and the fusing of technologies into one practical system.

F. Evaluation Techniques

1) Break the class into teams of two students each. Drill each team separately in the skills required to assemble the laser fiber-optic system, transmit a message, and accurately record the message on paper. Give each team in turn a standard, pre-recorded message on cassette. Teams are to be graded on speed of transmission and accuracy of transcription.
2) Have individual students research and report on the history and development of laser fiber-optic communication lines. Students may choose to report on this topic using either of two options:
   a) Use a combination of word processing and graphic techniques to prepare a report.
   b) Use appropriate techniques to produce a video presentation (Thode, 1987).
3) Construct and administer a test, requiring students to define the major parts of a laser fiber-optic system, and describe how that system operates.
4) Evaluate listening, reading and viewing habits of individual students during class.
5) Observe student participation in group activities during class.
6) Have students interview telephone company personnel regarding opinion on laser fiber-optic technology, and report to the class.

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TECHNOLOGY LEARNING ACTIVITY #10

INTRODUCTION TO DESKTOP PUBLISHING

A. Overview

The field of desktop publishing burst on the scene in early 1985, with the introduction of Apple Computer's LaserWriter output device. The LaserWriter was the first affordable device to offer plain-paper type and image setting of acceptable quality for office publications. The LaserWriter, along with the Apple Macintosh computer and the Aldus PageMaker software, provided the basic elements for what Aldus President Paul Brainerd described as "desktop publishing".

There is probably no one event, invention, method or process that has had such a profound effect on the production of typographic images as desktop publishing technology. The net effect of this new technology is the displacement of trade typesetting, and several pre-press printing trades, by workers in the office environment. It has also conferred much greater control of product and tremendous cost savings to the printing consumer, although sometimes at the expense of quality through inexperience (Kleper, 1990). The challenge of meeting this new technology with well-trained, technically adept craftsmen will prove to be troublesome. Not only does equipment capability expand yearly in seemingly exponential rate of speed (Boyce, 1990), but now the individual operators of desktop publishing systems are called upon to exhibit multiple abilities (Standera, 1987), to become amalgams of several highly skilled tradesmen,

in order to exploit the new technology to the fullest. It becomes very important to expose students to this popular technology, as many will encounter it in the workplace.

In this activity, students will be introduced to desktop publishing technology through the use of appropriate hardware and actual desktop software, called The Newsroom. The class will write, design, typeset, layout and print a one-page newspaper, using a desktop publishing system. In doing so, the student will gain a basic understanding of the structure, operation and capabilities of a desktop publishing system.

B. Major Concerns to be Addressed

1) Communication can be accomplished through use of computers.
2) Information can be channeled and directed through use of computers.
3) Assembly of an effective printed page requires skilled manipulation of many elements.
4) Solutions to practical problems often involve a combination of subsystems from different aspects of technology (University of the State of New York [UNY], 1988).
5) Communication technology represents an ongoing, evolutionary process of change.

C. Equipment and Supplies

1) The Newsroom software. Available through:

Springboard Software, Inc.
7807 Creekridge Circle
Minneapolis, Minnesota 55435
(612) 944-3912
(612) 328-1223

2) Personal Computer (Apple II or IBM PC).

3) LaserWriter Printer.

4) LaserWriter Paper.

5) Pencils and Paper.

(North Carolina State [NCS], 1987)

D. Procedure

I. Introduction

This software package, aimed particularly at student-aged users, attempts to mimic the environment of the newspaper, and all its functions. The Newsroom breaks these into six production divisions. They are the Photo Lab, where pictures are taken and developed; the Banner (masthead) production department, where the banner is designed; the Wire Service room, where text is sent and received via modem; the Copy Desk, where text is composed and combined with photographs; the Layout table, where the banner, text and photographs are assembled into pages; and the Pressroom, where the pages are printed (Kleper, 1990).

1) Introduce students to a glossary of terms encountered in The Newsroom software:

BANNER:	Name of a newspaper in large letters across the top of the front page, logo or flag.

BOOTING:	The process of loading computer program into computer by following the manufacturer's suggested method.
CAPTION:	A label beneath, or above, a photo.
CLIP ART:	Artwork available for photos in The Newsroom.
COLUMN:	Vertical division of text in the make-up of a newspaper, or: Regularly appearing articles in a newspaper that are written by the same person, and reflecting a particular point of view.
COPY DESK:	The work area where newspaper panels are created.
DATA DISK:	Computer disk that is used for storing completed work.
FONT:	A complete set of types in one type size and one type style.
HEADLINE:	Large type summarizing the contents of an article.
LAYOUT:	Work area where panels and banners are arranged into newspaper pages.
PANEL:	A section of a newsroom page, roughly one-eighth of a page, that may contain pictures, text, and headlines.
PHOTO LAB:	Work area where photos are chosen, arranged and altered to fit.
PRINTING PRESS:	Work area pages are printed as arranged in the Layout work area.
TEXT:	Written story.
WIRE SERVICE:	Computer process, using a modem, where computers can hook together over the telephone system to transfer text and photos.

2) Give students an overview demonstration of the function keys in The Newsroom software:

	(open apple):	selector key.
	(closed apple):	selector key.
RETURN	(return key):	selector key when saving to a disk.
	(arrow keys):	moves the cursor in a designated direction.
CTRL - S:		toggles between large/ small step in cursor movement.
CTRL - A:		turns sound on and off.

3) Give students an overview demonstration of the Main Menu options in The Newsroom software:

BANNER:	Allows the user to create a banner, or logo.
PHOTO LAB:	Allows the user to choose and create pictures (photos) for positioning within the news page.
COPY DESK:	Work area where the text (copy) is written.
LAYOUT:	Allows a user to arrange created panel (copy and photos) and banners on a news page.
PRESS:	Allows the user to print a photo, banner, panel or news page.
WIRE SERVICE:	Allows a user to send or receive papers, panels, banners, or photos via a modem and phone line.

II. Demonstrate The Newsroom Work Areas.

(Note: Put the master program disk in Drive 1 and the clip-art disk in Drive 2.)

1) Banner.

Highlight and select BANNER from the Main Menu.

a) Choose a photo from the Clip Art disk.

i. Select the Clip Art icon.

ii. Choose the desired work from the list.

iii. Move the cursor (hand) on top of the desired photo and select it with the function key.

iv. Move the photo to the desired location on the banner.

v. Drop the photo into place by pressing the selector key.

vi. Remove the original or "extra" photo by dragging it off the left side of the workspace.

OPTION: To flop the photo, select the Flip icon. Move the cursor on top of the photo and press the selector key.

b) Create a photo using the Graphic Tools.

i. Select the Crayon icon.

ii. Choose the desired Graphic Tool by placing the cursor on top of the appropriate tool and selecting.

iii. EXIT to the workspace.

iv. Drop the tool by pressing the selector key.

v. Use the arrow keys and selector keys to draw the photo.

c) Adding text.

i. Select the Crayon icon.

ii. Choose the desired font style by placing the cursor on top of the appropriate type and selecting.

iii. EXIT to the workspace.

iv. Place the cursor where the text should begin.

v. Drop the cursor and begin typing.

vi. When the text is complete, press the selector key to move the cursor from the workspace.

OTHER ICONS:

The Magnifying Glass icon allows the the user to enlarge a portion of the screen.

OOPS

The Oops icon allows the user to undo what was just done.

The Garbage Can icon clears the work area.

MENU

The Menu icon returns the user to <u>The Newsroom</u> menu.

d) Saving the banner.

i. Select the Disk icon.

ii. Select the Save banner from the menu.

iii. Insert a data disk in Drive 2.

iv. Initialize the data disk.

v. Type the name of the banner and press RETURN.

vi. Return to the Main Menu.

2) Photo Lab.

Highlight and select PHOTO LAB from the Main Menu.

a) Choose a photo from the Clip Art disk.

i. Insert the Clip Art disk in Drive 2

ii. Select the Clip Art icon.

iii. Choose the desired work from the list.

iv. Move the cursor (hand) on top of the desired photo and select it with the function key.

v. Move the photo to the desired location in the workspace.

vi. Drop the photo into place by pressing the selector key.

vii. Remove the original or "extra" photo by dragging it off the left side of the workspace.

OPTION: To flop the photo, select the Flip icon. Move the cursor on top of the photo and press the selector key.

b) Create a photo using the Graphic Tools.

i. Select the Crayon icon.

ii. Choose the desired Graphic Tool by placing the cursor on top of the appropriate tool and selecting it.

iii. EXIT to the workspace.

iv. Drop the tool by pressing the selector key.

v. Use the arrow keys and selector keys to draw the photo.

NOTE: The remaining icons in the Photo Lab Work Area have the same functions as those in the Banner Work Area.

c) Taking the picture.

NOTE: Before a photo can be saved on disk, it must be cropped and have its "picture" taken.

i. Select the Crayon icon.

ii. Move the cursor back onto the workspace.

iii. Drop the cursor where the bottom left-hand corner of the cropping frame should begin.

iv. Move the cursor across the photo, framing the photo as the cursor moves.

v. When the photo is framed properly, press the selector key and a "picture" will be taken of the photo.

vi. Move the cursor off the left side of workspace.

d) Saving the photo.

i. Select the Disk icon.

ii. Select the Save photo from the menu.

iii. Insert a data disk.

iv. Type the name of the photo and press RETURN.

v. Return to the Main Menu.

3) Copy Desk.

Highlight and select COPY DESK from the Main Menu.

NOTE: Step #1 should be done first if the panel contains a photo.

a) Placing the photo in a copy area.

i. Insert the data disk on which the photo has been saved.

ii. Select the Disk icon.

iii. Select the Load Photo from the Menu.

iv. Choose desired work from the list.

v. Move the empty frame to a desired location on the panel.

vi. Drop the photo into place by pressing the selector key.

b) Adding text.

i. Select the Font icon.

ii. Choose the desired font style by placing the cursor on top of the appropriate type and selecting it.

iii. Move the cursor onto the workspace and begin typing.

NOTE: Do not press RETURN at the end of a line of text. The Eraser icon erases all text from the work area. To erase a character, use the arrow keys to place the cursor on top of the character to remove, and press the DELETE key.

NOTE: To insert new text within existing text, move the cursor to where the new text should appear and type.

NOTE: If there is no longer any room in the panel for text or photos, save the panel, clear the work space and continue.

NOTE: The remaining icons in the Copy Desk Work Area have the same functions as those in the Banner Work Area.

4) Layout.

Highlight and select LAYOUT from the Main Menu.

a) Arranging the page. Select the appropriate layout options from the two menus.

b) Lay out the page.

i. Insert the data disk on which the panels have been saved.

ii. Move the cursor to a panel/banner area.

iii. Press the selector key to view a list of saved panels/banners.

iv. Use the arrow keys to scroll through the list.

v. Highlight and select the desired panel/ banner; the name of the panel/banner will appear in the designated area.

vi. Continue assigning panels/banners until the page is complete.

c) Saving the page.

i. Highlight and select SAVE from the Layout Menu.

ii. Type the name of the page and press RETURN key.

iii. Return to the Main Menu.

5) Press.

Highlight and select PRESS from the Main Menu.

a) Printing the page.

i. Select Print Page from the Menu.

ii. Insert the data disk on which the page has been saved.

iii. Select the page to print by scrolling through the titles, highlighting and selecting.

iv. Insert paper into printer, and print out.

(NCS, 1987)

III. Have students submit articles for publication.

1) Assign appropriate research topics to each individual student, or group of students.

2) Have students keyboard or hand-write an article for submission to the class newspaper. State a minimum and maximum number of words for each article.

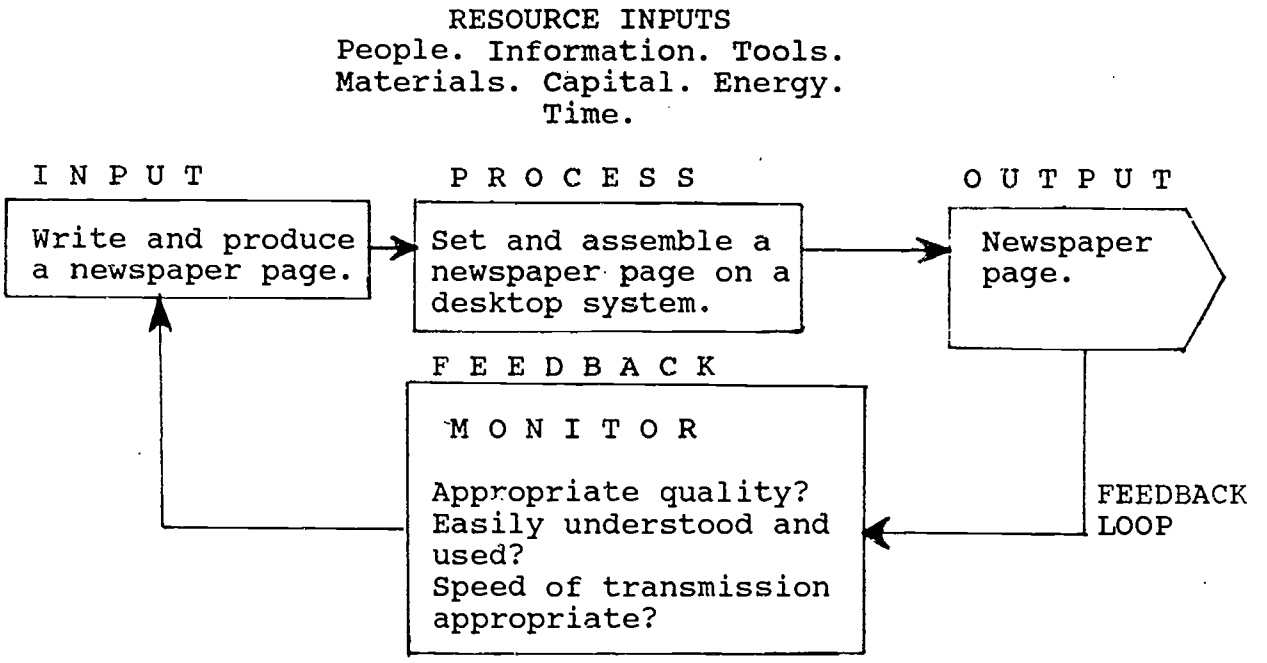
3) Approve each article, acting as news editor. Particular attention must be given to grammar, spelling and punctuation.

IV. Create Newspaper pages, as a small-group activity.

1) Break the class into small, manageable production groups.
2) Have each group load or keyboard their own articles, and utilize The Newsroom software to create a newspaper page.
3) Allow each group to output their finished newspaper page on the LaserWriter printer.
4) Distribute xerox copies of the finished newspaper page from each group to each individual student.
5) After inspection of each other's efforts, have the class comment on the activity. Lead a class discussion on the most interesting aspects of the activity.

E. Interdisciplinary Aspects of the Activity

1) System of Technology



Identify the role of the following resources in the system above: People, Information, Materials, Tools/Machines, Capital, Energy and Time (UNY, 1988).

2) Math: Formulas concerning the classical notions of proportion. The typographic point size system. Use of addition, subtraction, multiplication and division in manual copyfitting -- which can be contrasted in terms of the time required to execute with the nearly automatic fu tion of desktop publishing systems in this regard.

3) Science: Discuss laws of physics concerning electricity; Ohm's law, Lenz's Law. Talk about the speed of communication with electricity, versus other mediums.

4) English: Writing and editing to produce clear, concise, and grammatically correct articles for the class newspaper project. Accuracy in spelling and punctuation. Oral use of technical vocabulary (UNY, 1988).

5) Social Studies (Human and Social Impacts): New technologies sometimes displace older ones, and with this comes the elimination of jobs; discuss the impact of desktop publishing on the typesetting trade. Some feel that the personal computer is adding considerable stress on society (Boyce, 1990); ask the class for opinions on whether or not this is the case, citing examples. Improvements in information technology, such as desktop publishing, have improved the process of accessing information, but may not result in a parallel improvement in the human understanding of information. Discuss with the class how easy access to information can lead to information overload, decreasing understanding of communication (Kleper, 1990).

6) Psychomotor Skills: Students will develop or improve hand-eye coordination and manual dexterity in writing or keyboarding news articles, and in the typesetting and manipulation of copy and artwork through the desktop keyboard, using The Newsroom software.

7) Safety and Health: Discuss the potential physical hazards of electrical equipment in communications technology. Review current thought and controversy

regarding safe viewing distances from monitor screens. Establish procedures for laboratory clean-up.

8) Career Related: Students will engage in activities related to careers in journalism, writing/editing, advertising, photography, customer service, secretarial service, typesetting/printing, electronic office publishing and graphic design.

9) Creative Problem-Solving: Opportunities are provided to students through the writing and editing of text blocks; the placement of text blocks and headlines on a page; in cropping illustration work and in regarding proportion and balance in page layout.

10) Transfer of Learning: Application of copywriting, text input, text organization and output techniques to many personal or business requirements. Familiarity with the personal computer as a tool, which is directly transferable to other life situations and technologies.

F. Evaluation Techniques

1) Break the class into four groups, and assign each to organize and publish at least one issue of a two-page (one leaf) newsletter, using The Newsroom software. Assign special-interest areas to each group (e.g., school-wide news, sports, industrial arts/technology education, art, humor, etc.) (NCS, 1987).

2) Construct and administer a test requiring identification of Newsroom software icons, function keys, menu options;

hardware elements; and definition of terms encountered in using The Newsroom software.

3) Break the class into several groups, and have each group organize and publish a small newsletter, jointly, with another school, using a modem and the Wire Service Option available in The Newsroom software (NCS, 1987).

4) Have students research and report (either written or oral) on the impact of desktop publishing technology on the workplace, most particularly with regard to the office environment.

5) Evaluate listening, reading and viewing habits of individual students during class.

6) Observe student participation, during class time.

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TECHNOLOGY LEARNING ACTIVITY #11

INTRODUCTION TO ELECTRONIC MAIL

A. Overview

One aspect of the ever-changing field of computers in communication is the growing use of electronic mail/message systems, or "E-Mail". These are general terms describing the transmission of messages via computers and telecommunications facilities. As a result of these advances in communication technology, it is possible for persons to have immediate access to messages, educational resources, information services and each other -- even when they are separated by great distances (Wishnietsky, 1992).

The crucial link between the personal computer and standard telephone lines is a device called a modem (modulator/ demodulator), which handles the electronic translation and transfer of digital information at speed (Kitzman, 1988). It is the modem that allows the network of personal computers to extend beyond a local, cable-connected formation to the ends of the earth, through the agency of telephone lines and satellite transmission. This capability unlocks the real power of electronic mail. In a matter of seconds, an electronic file from one personal computer can be shared with another located thousands of miles away. Today an estimated eight to 15 million people use electronic mail for at least part of their regular correspondence (Wishnietsky, 1992).

Electronic mail was developed primarily because of the inherent limitations of postal and telephone service. In

comparison to electronic mail, the postal service is slow and undependable. The telephone is not effective unless the sending and receiving party are available at the same time. An electronic mail system can eliminate "mailroom drag" and "telephone tag" through electronic transmission, storage and delivery of messages. In a way, access to an electronic mail system can be compared to a personal post office box, open 24 hours a day (Wishnietsky, 1992).

In this activity, students will learn the basics of the modem and an electronic mail system. Students will set up and use the CompuServe Mail service, in order to demonstrate this form of electronic communication.

B. Major Concerns to be Addressed

1) Computers can be used to transmit messages.
2) Computers can channel messages through the telephone system.
3) Electricity can be used to transmit signals.
4) Signals can be organized into codes, in order to effect communication.
5) Solutions to practical problems often involve a combination of subsystems from different technologies. (University of the State of New York [UNY], 1988)
6) Communication devices are constructed of various materials and consume energy in production and use (Hayden, 1986).

C. Equipment and Supplies

1) Personal computer.

2) Modem. Parameters required: 1200, 2400 or 9600 baud.
Even parity.
7 data bits.
1 stop bit.
Full duplex.

3) Communications software package. Many are available; some of the most popular are:

Procomm Plus
Datastorm Technologies
P. O. Box # 1471
Columbia, MO 65205
(314) 443-3282

Microphone II
Software Ventures Corporation
2907 Claremont Avenue
Berkeley, CA 94705
(415) 644-3232

Crosstalk for Windows and Crosstalk Communicator
Digital Communications Association, Incorporated
1000 Alderman Drive
Alpharetta, Georgia 30202
(800) 241-4762

Blast
Communications Research Group
5615 Corporate Boulevard
Baton Rouge, LA 70808
(800) 242-5278

4) CompuServe subscription/membership kit. Available through:

CompuServe
5000 Arlington Centre Boulevard
Columbus, OH 43220
(800) 848-8199

(Note: Ask for a free "trial subscription")

(Nimersheim, 1992).

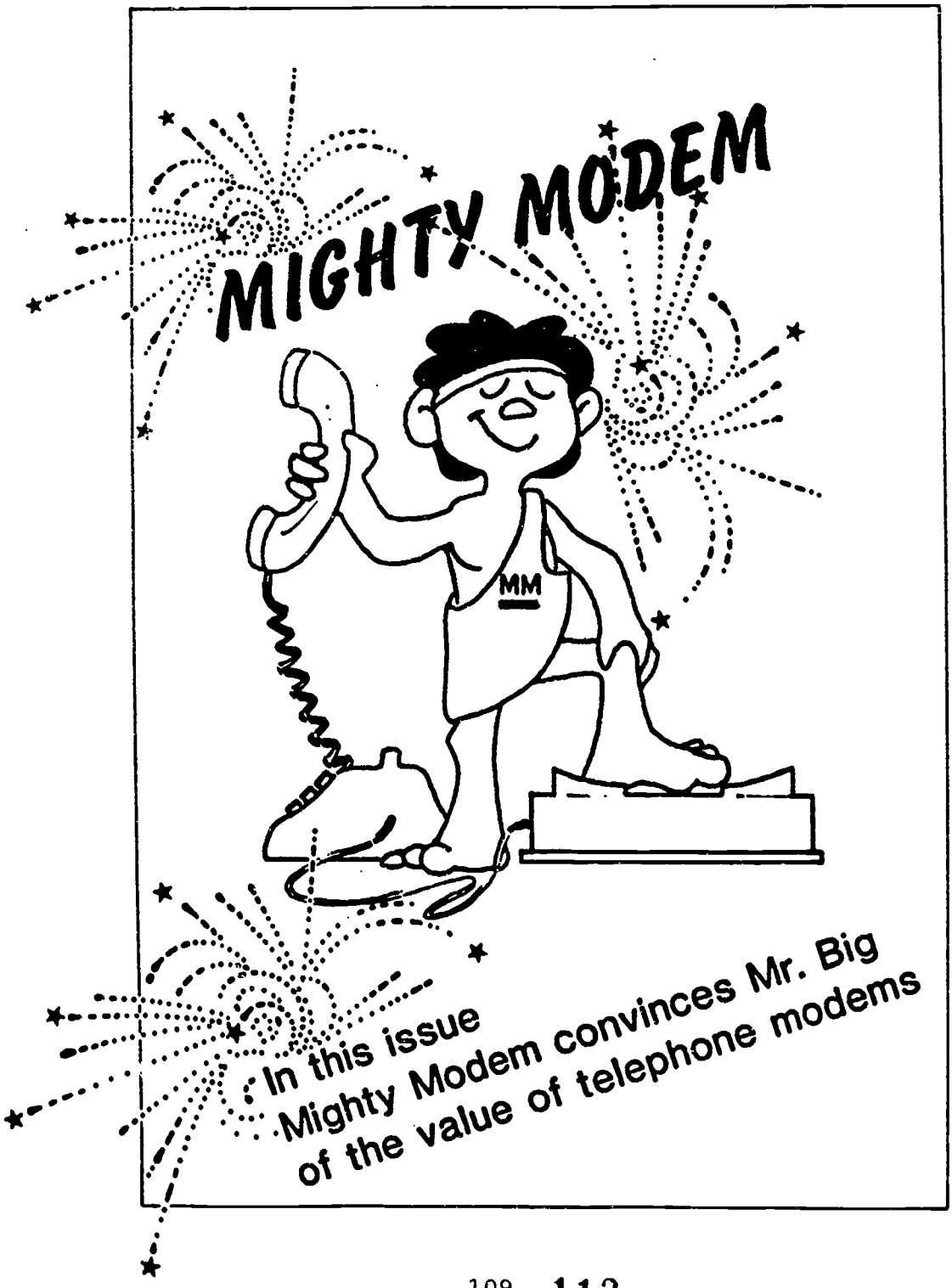
5) Access to telephone line, through a telephone or direct wall jack (dependent on type of modem employed).

6) Appropriate adaptor cables for modem, personal computer and telephone line.

D. Procedure

1) Preparation for the Activity:

a) Make copies of the following nine-page cartoon booklet, Mighty Modem, for distribution to the class:



Place: Littletown, U.S.A.
Scene: Littletown Manufacturing Company
President's Office

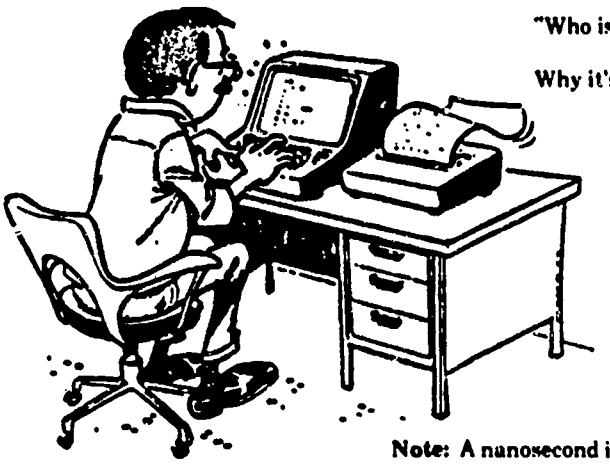
Mr. Big: "We have a problem! Our newest account is *demanding* inventory and production data from us every hour. We can't keep taking our computer operators off their terminals to call our other plant in Great Falls and then phone all that information to Big Bopo Inc. This way just takes too much time. Does anyone have any suggestions?

Meanwhile:
At Digitron World Headquarters, mild-mannered computer programmer Harold Sharp senses impending disaster someplace in Computerworld . . . .

As fast as his fingers will move over the keyboard, Harold programs in his secret code:

007E7E7818181800

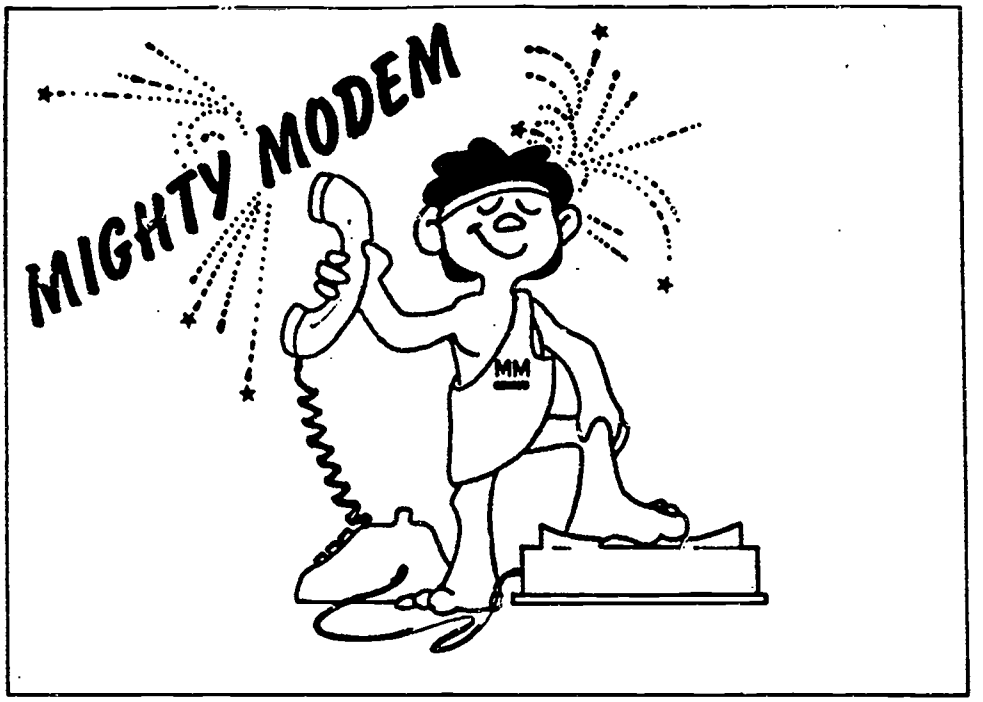
In barely a nanosecond, he is transformed into that famous work and data saver who transmits data faster than a speeding bullet.



"Who is this wonder?" you ask.

Why it's. . .

Note: A nanosecond is one billionth of a second.



Back in Littletown: Just a few seconds later, in through Mr. Big's phone line comes *Mighty Modem*.

Mr. B: "What the heck are you?"

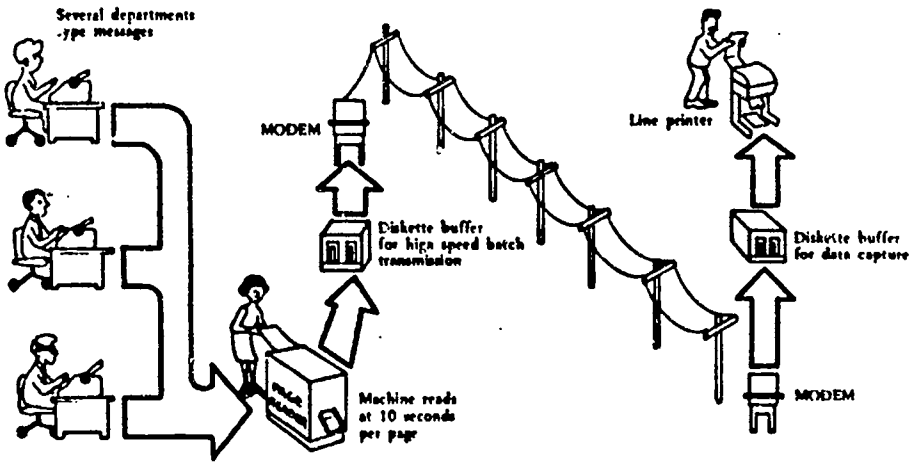
MM: "Well, Mr. B, I'm a *modulator/demodulator* capable of sending and/or receiving signals over telephone lines by specially coded messages. You can call me *Mighty Modem*."

Mr. B: "What are you doing here?"

MM: "I came to help you solve your communications problem. I can change into any modem combination you might need to transmit information and/or data from one place to another with amazing speed and accuracy (if I do say so myself)."

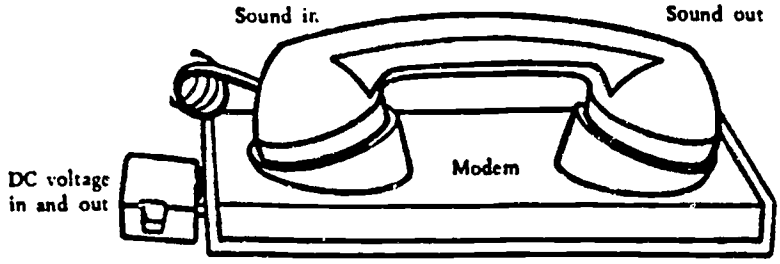
Mr. B: "That doesn't tell me much. Go on, I want to hear more."

MM: "Well, Mr. B, electrical signals from your computers or terminals are converted by me (*modulated*) into audio tones that are fed into my speakers and then on to the telephone lines. Once in the phone lines, the data is transmitted to another modem. The signals are picked up at the other modem by its microphone. From the microphone, the signal is *demodulated*, or converted back into electrical signals that can be recognized by the computer. Often times, this talking back and forth between computers and terminals is called *handshaking*."



Mr. B: "You'll have to do more than just jump out of telephone lines to help me buddy!"

MM: "Just look at what I can do! I can become an *acoustic modem* or a *direct-coupled modem*."



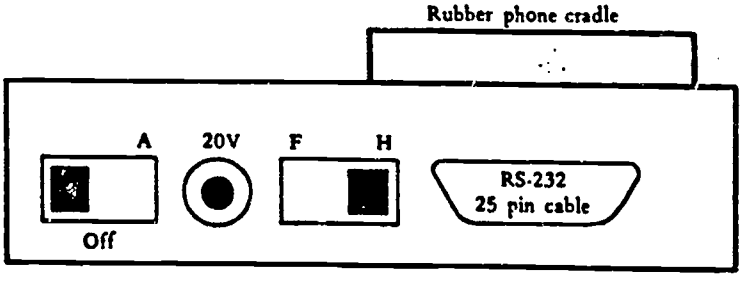
Note: Acoustic Modem: A device in which a telephone handset is plugged into two rubber cups. One side of the modem is connected to a computer, and the other is connected with telephone lines. The modem allows data to connect with the phone with a carrier tone.

Direct-Coupled Modem: This modem is wired directly to the existing phone line. The phone does not have to be manually connected to the modem. This device is capable of answering the phone when it hears the carrier tone.

The acoustic modem above shows the basic parts of most modems. There must be a sound or signal going into the modem, signal going out, and an AC/DC power voltage to power both in and out signals. A direct-coupled modem looks a little different than the one shown.

Mr. B: "You still haven't convinced me. What else do I need to know before I can get started?"

MM: "I can send data in either *full duplex* or *half duplex*. I can *originate* a signal and *answer* one, or originate transmissions only or answer transmissions



Note: Full duplex: This is a modem that is capable of sending and receiving data signals at the same time.

Half duplex: This is a modem that can transmit data in either direction, but it can only send or receive at any one time. This modem *cannot* do both at the same time.

Originate: The computer terminal originates the carrier tone for use over the phone lines (the most common use of the answer/originate modes)

Answer: This mode is used when two computers want to talk to each other or when the computer is being used as a receiving center for messages or data.

The diagram is an example of a simple modem that can be used for any of the above listed combinations when transmitting or receiving data. Most commercially purchased modems today are the answer/originate and full- or half duplex type.

Mr. B: "So, you say that you are fast. Well, just how fast are you?"

MM: "I can talk (send signals) at a variety of *baud* rates—anywhere from 110 bauds per second (bps) to 9,600 bps. At 300 bauds, I send one *bit* of information in 3.3 milliseconds to another computer or terminal.

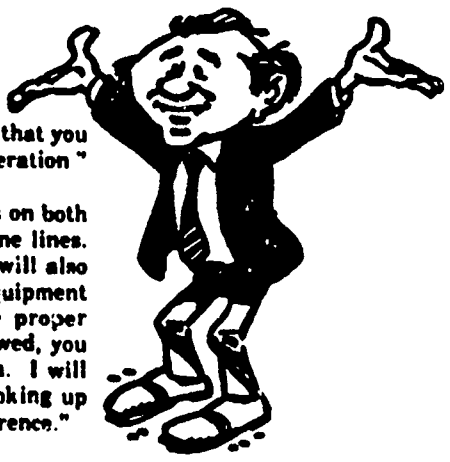
Now, wouldn't you say that's fast? I'll bet that all of your computer operators combined couldn't send information to another computer that fast!"

Note: Baud: A unit of signaling speed. The speed in bauds is the number of signal elements per second.

Bit: The smallest unit of information in computer language.

Mr. B: "Look, *Mighty Modem*, I'm convinced that you can help us. Let's get you hooked up and in operation."

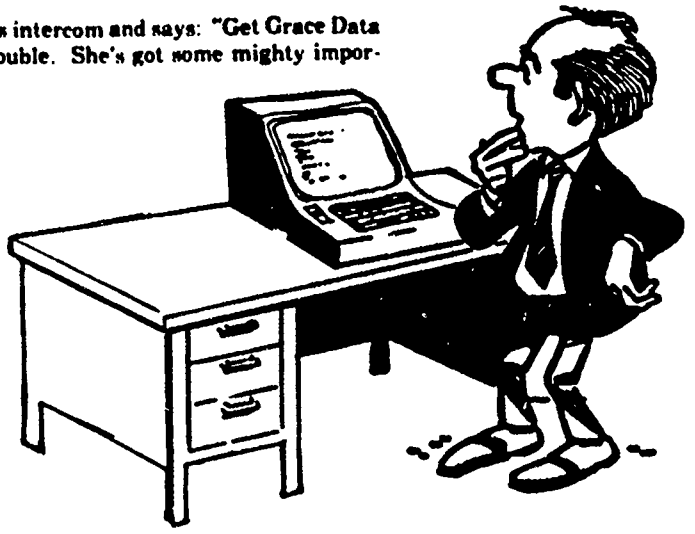
MM: "Hold on. First you will need modems on both the *originate* and the *answer* end of the phone lines. Each computer or terminal to be hooked in will also need an *RS-232* cable. Once you have this equipment ready to go, it must be connected in the proper sequence. If these connections are not followed, you may have problems and receive garbled data. I will put the proper installation procedure for hooking up your modems on your computer screen for reference."



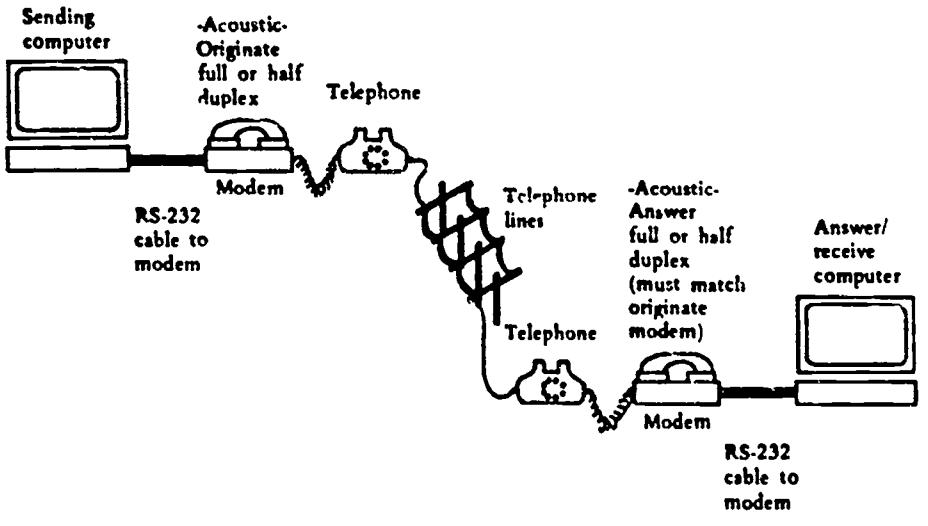
Note: RS-232: This is an industry standard for interconnection of equipment. It can be connected for parallel transmission, in which data travels down eight parallel wires simultaneously, or for serial transmission, in which data travels bit by bit down one wire in a stream of bits.

As Mr. B turns to view his computer screen, our super hero transmits himself back over the phone lines to his desk at Digitron World Headquarters.

Mr. B turns to his intercom and says: "Get Grace Data in here on the double. She's got some mighty important work to do!"

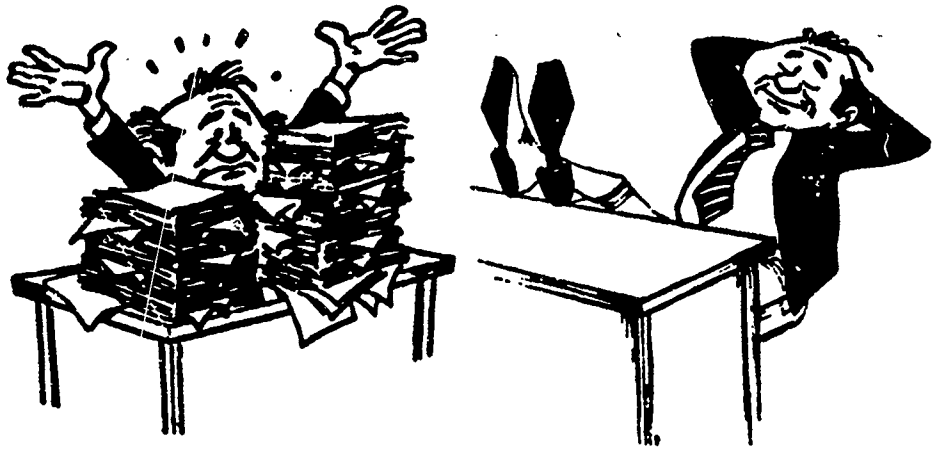


Note: Here is what *Mighty Modem* puts on the computer for Mr B to see. It is the special hookup for using modems.



Mr. Big of Littletown Manufacturing Company is now happy. His modems are working and transmitting data by the hour to his many new accounts. By using modems, Mr. B is saving time and money. There are fewer mistakes in data received, and all of the new accounts are pleased with the increased speed and efficiency. This has transformed Mr. B

from this ..... to this



As for our super hero, he is back as usual at his desk programming, answering questions, and waiting—waiting for his next call for help as *Mighty Modem*. He's doing his part to help keep those computers and terminals talking via telephone modems.

b) Hook up the personal computer, modem and phone line, and load the communications software. Using the access number, user ID number and password provided by CompuServe and the procedural information given in the CompuServe membership kit, navigate the system in order to familiarize yourself with its layout.

c) Using the procedural information found in the CompuServe membership kit, access the Membership Directory Option under the Member Assistance Menu. Use the Membership Directory to locate a suitable message receiver/sender for your class in their electronic mail exercises; a similar companion class in another part of the country would be ideal. An alternative would be to contact friends or colleagues in other school districts who may have a companion class with similar needs.

d) Again using the procedual information set forth in the CompuServe membership kit, send a short message to your own mailbox address. This will allow for a more complete demonstration of the CompuServe Mail system in presentation to class.

2) Introduce the Modem Concept:

a) Distribute the cartoon booklet Mighty Modem to the class. Give the students time to read the booklet.

b) Lead the class in a discussion of the importance of the modem, in allowing the personal computer to network worldwide.

c) Demonstrate to the class how to hook up the personal computer, modem and telephone line.

d) Describe the parts of the electronic mail communication system to the class (e.g., parts of the modem, personal computer, software, adaptor cables, etc.).

3) Access and Use CompuServe Mail:

a) Demonstrate to the class how to sign on to the CompuServe system by using appropriate access number, user ID number and password.

b) Show the class how to access CompuServe Mail quickly, by using the "GO MAIL" command.

c) Point out to the class the "MESSAGE PENDING" prompt that occurs on the screen, to inform the user that a message is waiting; in this case, it is your own previous effort. Demonstrate to the class how to display that message through the "READ" command, and comment on the electronic storage facility of electronic mail.

d) Discuss and demonstrate other CompuServe Mail commands: "SEND", "DELETE", "EXIT", "SAVE", "SCAN", "SEARCH", "HELP" (Nimersheim, 1992).

e) Show the students how to access their companion electronic mail class. Through pre-arrangement with the instructor at that distant site, both classes may meet simultaneously, but such a situation is not required, as electronic mail can be stored.

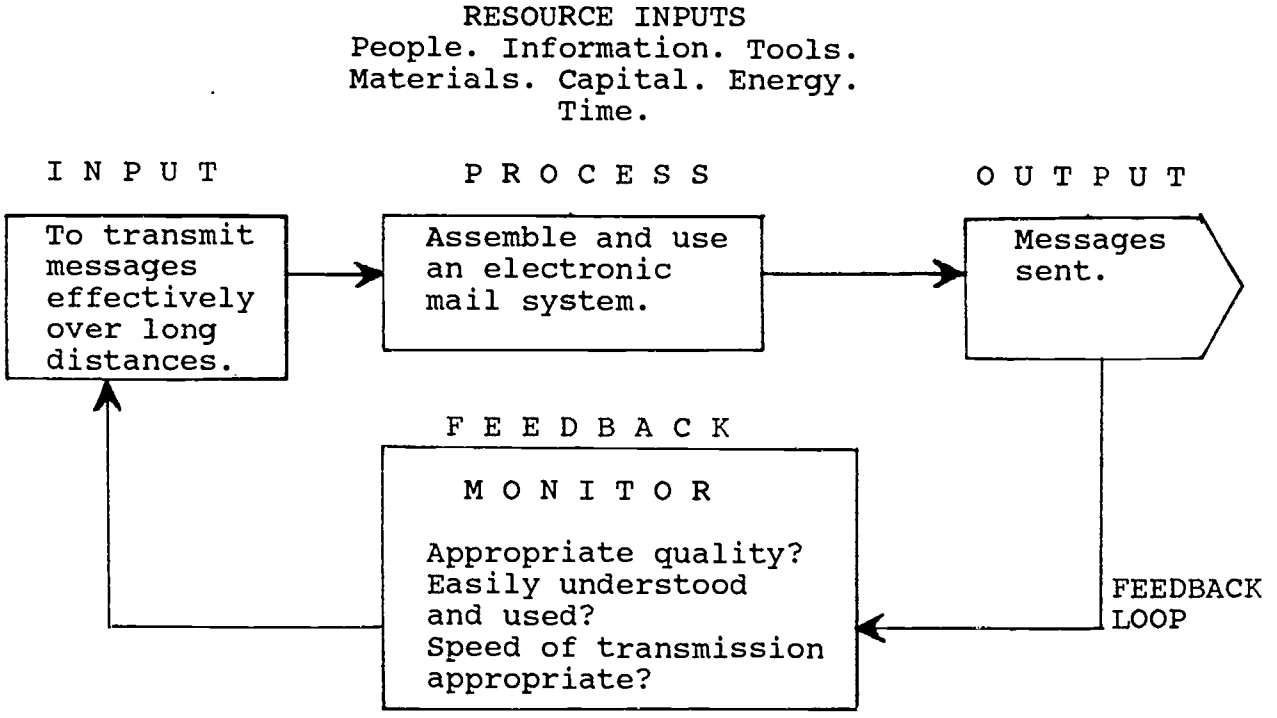
f) Have each individual student, or small group of students, send a message to the companion class over the CompuServe Mail system. This message would ideally contain questions related to the conditions characteristic of the location for the companion class. The companion class would likewise respond.

Central to the success of this section is involvement by every student in the class, whether in posing questions or in keyboarding and sending the actual message. Care must be taken to see that each student has some sense of having shared in communicating with the companion class.

g) Lead a student discussion of attitudes and feelings towards this exercise.

E. Interdisciplinary Aspects of the Activity

1) System of Technology:



Identify the role of the following resources in the system above: People, Information, Materials, Tools/Machines, Capital, Energy and Time.

(University of the State of New York [UNY], 1988)

2) Math: Students in schools located in different parts of the country can research the price of certain products in their local area, share their data via CompuServe Mail and calculate percentage differences, developing charts and graphs to report results (Wishnietsky, 1992). Have students research and report on the cost-effectiveness of various electronic mail systems (e.g., CompuServe Mail, AT&T Mail, Sprint Mail, Western Union Easylink, Delphi, BIX, Prodigy, GEnie, etc.). Binary notation in electronic systems.

3) Science: Students in different schools can record and share weather data, comparing daily average temperatures and rainfall amounts (Wishnietsky, 1992). Discuss the laws of physics concerning electricity. Speed of communication with electricity, versus other mediums. Analog versus digital signals, and the role of the modem in conversion of same.

4) English: Keyboarding clear and grammatically correct messages for transmission via electronic mail; accuracy in spelling and punctuation. Oral use of technical vocabulary (UNY, 1988). Students could use CompuServe Mail to critique each other's prose or poetry, or work together to write a short story.

5) Social Studies (Human and Social Impacts): Have students create an electronic mail travel brochure of their own region to share with students from other parts of the country; this could include demographics, climate, geographical features, etc. Ethical issues regarding computer use (e.g., privacy of information, alteration of data, viruses, software copyright infringement). Many educators feel that our society is developing two classes of people, predicated on economic advantage: computer literate and computer illiterate. Have students debate this concern in class (Wishnietsky, 1992). Discuss with the class ways in which electronic mail may be helping to shape the world into a global community.

6) Psychomotor Skills: Students will develop or improve eye-hand coordination and manual dexterity in assembly of the electronic mail system in class, and in keyboarding messages sent on that system.

7) Safety and Health: Discuss the potential hazards of electricity. Review current thought and controversy regarding safe viewing distance from the monitor screen of the personal computer. Discuss how rapid communication, such as the type made possible by electronic mail, can alert people of impending emergencies and save lives (UNY, 1988).

8) Career Related: Students will engage in activities related to careers in the fields of electronics, journalism, writing/editing, telecommunications and secretarial service. Students will also observe the role of a technology education teacher.

9) Creative Problem-Solving: Opportunities are provided to students through the assembly and use of the electronic mail system, particularly with regard to the modem; and in the thought processes involved in gaining access to information on the CompuServe Mail system.

10) Transfer of Learning: Application of techniques encountered in the assembly and use of the electronic mail system to other technological situations (UNY, 1988), particularly with regard to the use of a modem, personal computer networking, and the keyboarding of information.

F. Evaluation Techniques

1) Have individual students contact friends or relatives in distant locations through CompuServe Mail. Students will ask about the uses of electronic mail at those particular stations, and report to the class their findings.
2) Construct and administer a test requiring students to identify and describe the parts of an electronic mail system.
3) Electronic mail is but one facet of the CompuServe telecommunications system. Have individual students research and demonstrate to the class other options available through CompuServe (e.g., Electronic Mall, Bulletin Boards, Travel Information, etc.).
4) Have students speculate on the impact of global electronic mail in the future, presenting a brief oral report to class on that topic. This can be a springboard to a class discussion on the topic afterwards.
5) Evaluate the listening, reading and viewing habits of individual students during class.
6) Observe student participation in group activities during class.

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TECHNOLOGY LEARNING ACTIVITY #12

REFLECTION HOLOGRAPHY

A. Overview

Holograms are three-dimensional images that offer a viewer the same advantages of perspective and parallax as the original scene. A shift of the head will produce a new perspective when viewing a hologram, in effect enabling the viewer to look around the corner of a photograph (Jearl, 1980).

British scientist Dennis Gabor originated the basic concept of holography in 1947; but he could produce none because the world had yet to develop a suitable coherent light source. That opportunity came in 1960 when U.S. scientists Juris Upatnicks and Emmet Leath used a newly-invented laser to produce the first hologram, showing an object in its three-dimensional form (Kitzman, 1988).

Current uses for holography include the measurement of microscopic stress, motion and vibration in machinery; portraiture; and counterfeit protection on credit cards (Schlegel, 1986). But in the future, communication technology will doubtless intertwine with holography. Some suggest that 3-D images will float into our living rooms, projected by the television; persons making telephone calls will "beam" 3-D images of one another across the continents; there will be holographic cinemas, billboards and amateur holographic photography. Holography is on the verge of becoming a widely-employed component of many communication systems. After

a few technical breakthroughs concerning laser cost and acceleration of transmission speed have been accomplished, the revolution will occur; our students may actually be able to contribute to these breakthroughs (Unterseher, Hansen & Schlesinger, 1982).

In this activity the student will learn directly by controlling a laser light beam through means of an exposure system, then exposing and developing film to produce a white-light, reflection hologram. The student will gain firsthand knowledge of the characteristics of holograms through this basic introduction.

B. Major Concerns to be Addressed

1) Light can be used to transfer imagery to chemical emulsions.
2) Laser light can record interference patterns as three-dimensional imagery on a chemical emulsion.
3) Laser light can be channeled and directed.
4) Technical procedures may involve a combination of subsystems from different technologies (University of the State of New York [UNY], 1988).
5) Communication devices are constructed of various materials, and consume energy in production and use (Hayden, 1986).

C. Equipment and Supplies

1) Photographic laboratory, or darkroom.
2) Class II Helium-Neon Laser.

3) Front surface reflection mirror.

4) Diverging lens.

5) Scissors.

6) Film: AFGA 8E75 (NAH).

7) Photographic chemicals: KODAK D-19 Developer.
KODAK Photo-Flo

8) Green safelight.

9) Vibration-free table.

10) Developing trays, and tongs.

11) Film holder (two glass plates with clips).

12) Stands, to hold the front surface mirror and the diverging lens.

13) Object to record as a hologram.

14) Cardboard pieces, approximately 6" x 6".

15) Black bags.

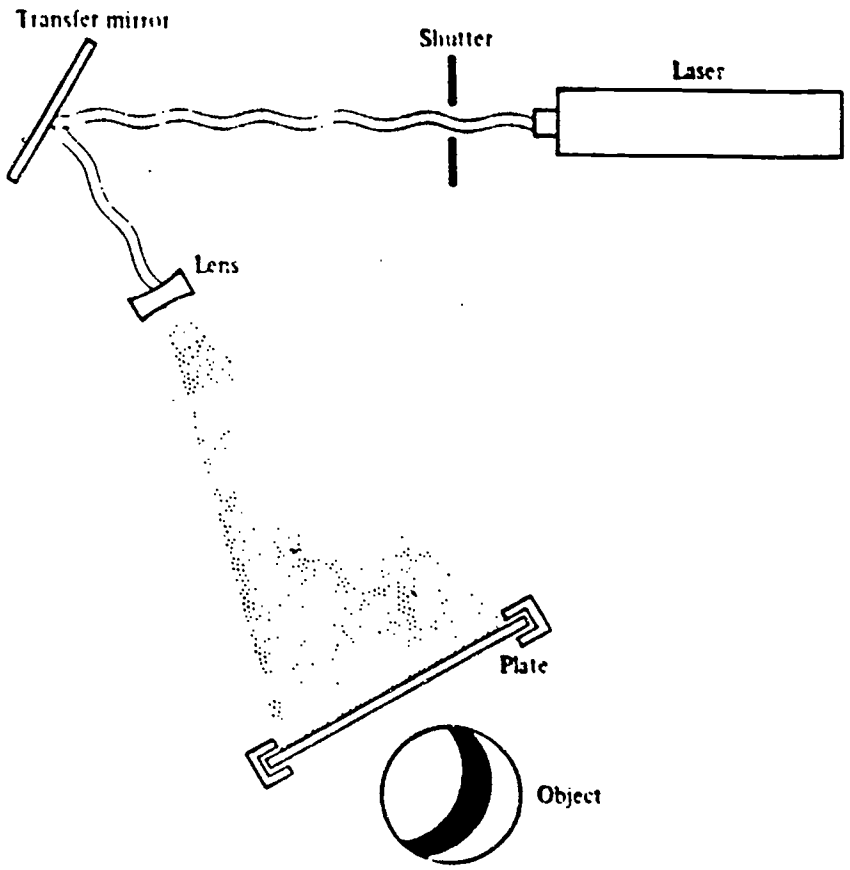
16) Sponges.

D. Procedure

1) Set-up for the activity.

a) Have individual class members choose appropriate three-dimensional objects as subject matter for their reflection holograms.

b) Position all materials as per the following diagram. Please note that the film holder must be given a solid surface as a support, because the slightest vibration can ruin a hologram in exposure.



c) Turn on the laser, and turn off the room light.

d) Check to see that the laser light passes through the diverging lens, and reflects off the transfer mirror at a 60-degree angle.

e) Check to make sure that the light reflecting off the transfer mirror covers the object completely, after it passes through the film plane; make sure that the object is centered in the light.

f) Turn on the room lights.

g) Pour the D-19 developer, and Photo-Flo, into developing trays.

h) Using a piece of cardboard as a shutter, block the laser light.

i) Take care not to bump any of the equipment already set up. Mis-alignment would require re-working the set-up.

2) Exposing the film.

a) Turn on the green safe light. Note that this is the only light that can be on when handling the film during exposure and development. Handle the film on the edges, as fingerprints and dirt on the film can ruin the hologram.

b) Turn off the room lights.

c) Remove the film from its light-tight container, and cut an approximate 3" x 3" section. Place the remainder of the film back into the container, and place the 3" x 3" cut section into a black bag.

d) Turn on the room lights, and orient yourself to the equipment.

e) Practice opening, closing and placing the film holder back above the object so that it can be negotiated with ease. Remember that once the room light is off, the only illumination comes from the green safe light.

f) Turn off the room light.

g) Remove the 3" x 3" film section from the black bag. Determine the emulsion side of the film section; this can be done by moistening the lips and touching the corner of the film section -- the emulsion side will be sticky.

h) Place the 3" x 3" film section in the film holder emulsion side down, and secure it with clips.

i) Place the film holder back on its stand.

j) Lift the cardboard "shutter" off the table, and wait 20 seconds before exposing the film. This waiting period is important, as during exposure the table and entire set-up must be absolutely vibration free.

k) Lift the cardboard shutter away from the laser light, and expose the film for approximately seven seconds.

l) Replace the cardboard shutter, and turn off the laser.

3) Developing the film.

a) Remove the 3" x 3" film section from its holder; and place it, emulsion side down, in the D-19 developer. Slowly agitate, for five minutes. Remove from tray, letting excess drip off.

b) Wash the 3" x 3" film section in running water for about ten minutes.

c) Remove the 3" x 3" film section from the running water.

d) Place the 3" x 3" film section in the Photo-Flo tray, for 30 seconds.

e) Remove the 3" x 3" film section from the Photo-Flo tray, and gently wipe off the excess with a clean sponge.

f) Let the 3" x 3" film section dry completely.

4) Viewing the hologram.

a) Sunlight is the best source for viewing the hologram, but any white-light source (e.g., projectors, overhead viewer, etc.) will provide adequate illumination.

b) Hold the 3" x 3" film section so that the light source is behind you and the film is in front of you.

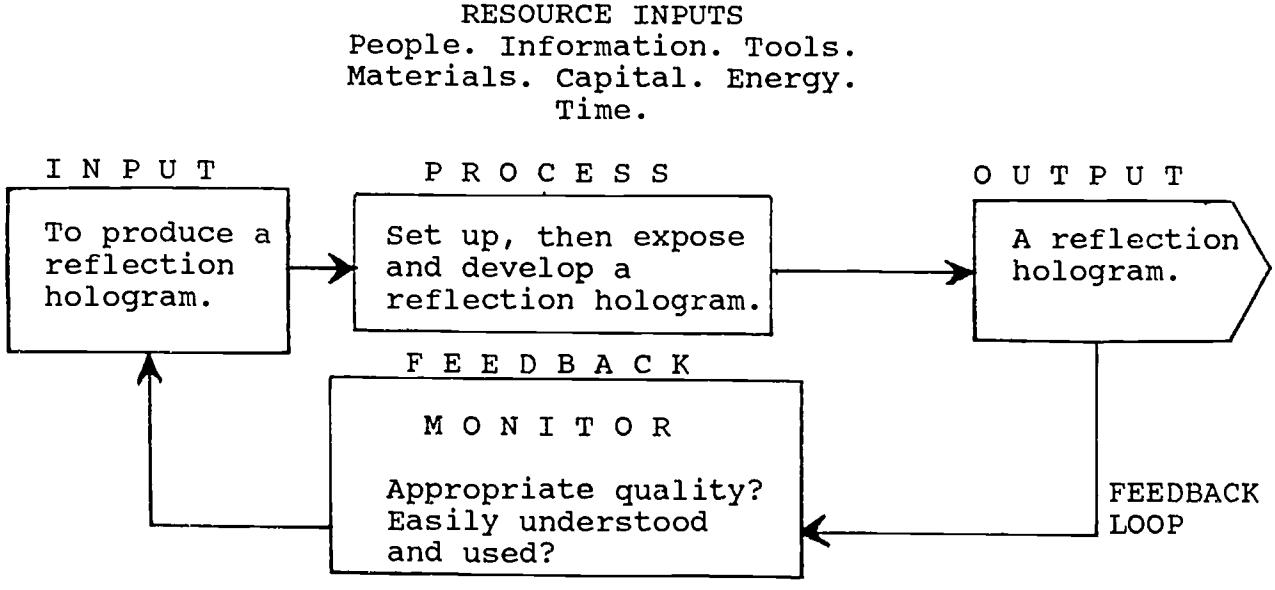
c) Turn the film section so that the emulsion side is facing away.

d) Move the film around until you see the real image of the object, which will seem to appear on the back of the film.

e) The virtual image of the object is seen by turning the film so that the emulsion side faces the viewer (Kitzman, 1988).

E. Interdisciplinary Aspects of the Activity

1) System of Technology



Identify the role of the following resources in the system above: People, Information, Materials, Tools/Machines, Capital, Energy and Time.
(University of the State of New York [UNY], 1988)

2) Math: The relationship of the speed of light to its wavelength and frequency (C=lv): Speed of Light = Wavelength X Frequency. The calculation of the speed of light, 186,282 miles per second (3 X 10^8 meters) in vacuum (Unterseher, Hansen & Schlesinger, 1982). Use of basic geometry in constructing an exact beam reflection angle of 60-degrees, off of front surface mirror.
3) Science: Wave theory of light, electromagnetic structure of light waves, and the wavelengths of the visible spectrum of light. Law of reflection. The characteristics of light (e.g., phase, amplitude, frequency). Refraction. Bragg's Law, or the Bragg condition. Diffraction (Unterseher, Hansen & Schlesinger, 1982). Energy conversion, from electricity to laser light. Discuss the properties of laser light (e.g., the four categories of laser power, monochromaticity, characteristics regarding divergence, etc.) (Balistreri, 1985). Lens and mirror technology. Chemical reaction principles. Vibration and isolation principles (Schlegel, 1986).
4) English: Speculate on the writing skills of our counterparts in the future, who will be able to transmit

holographic images of themselves while making a telephone call. Will there be a need for writing skills in the world of the future? Oral use of technical vocabulary, regarding lasers and holography.

5) Social Studies (Human and Social Impacts): Discuss the impact of holography today, as used in magnification, optical microscopy, interferometry, acoustic holography and microwave holography. Speculate on the future impact of three-dimensional holographic television, telephones, motion pictures and billboards (Kasper & Feller, 1985).

6) Psychomotor Skills: Students will develop or improve eye-hand coordination and manual dexterity in setting-up the holographic darkroom and exposure equipment; in exposing and developing the reflection hologram; and in viewing the finished reflection hologram.

7) Safety and Health: Discuss the potential physical hazards of laser light and electrical equipment. Teach the use of proper eye and hand protection in a laboratory setting. Talk about the dangers inherent in photographic chemicals. Establish procedures for clean-up. Speculate on how an adaptation of three-dimensional holographic techniques to the X-ray laboratory of the future might aid surgeons, speed surgical procedure and save lives (Balistreri, 1985).

8) Career Related: Students will engage in activities related to careers in the fields of electronics,

engineering, photography, fine arts, model-making and prototype construction. Students will also view the job of a technology education instructor.

9) Creative Problem-Solving: Opportunities are provided to students through the set-up of the holographic exposure and darkroom equipment, and the selection of an appropriate object for use as three-dimensional holographic subject matter.

10) Transfer of Learning: Application of problem-solving techniques encountered in the set-up of the holographic exposure equipment, including calculating for a 60-degree beam reflection, and arranging for vibration-free surfaces, to other technical problems. Exposure to basic photographic development technique, which is transferable to many processes.

F. Evaluation Techniques

1) Break the class into teams of two students each, and assign each team the task of making holographic portraits of each other. Please note these will need to be creative, as the use of a Class II laser precludes the use of the face as a subject, as the eyes would be subject to damage. Have the class mount an exhibit of the finished holography. Grade the students on the degree of response from the student body generated by the exhibit.

2) Construct and administer a test requiring students to identify and define parts of the hologram exposure set-up; definition of terms and processes relating to holography; and possible future connections for holography and communication technology.

3) Have students research and report (either written or oral) on the use of holography in the future of motion pictures, television, and computer data storage.

4) Have individual students locate and interview holographic photographers or research personnel utilizing holographic interferometry as a measurement technique. Report to the class in a short, oral presentation.

5) Have students maintain a daily log-book of activities, for the period of one week, making note of which activities might conceivably lend themselves to an application of holography in the future. Students must then report their findings to the class, in a short, oral presentation.

6) Observe student participation in activities during class.

7) Evaluate listening, reading and viewing habits of individual students during class.

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