TECHNOLOGY EDUCATION

Grades 9-12

PROGRAM/COURSE History of Technology

JOB NO. _____ PAGE NA

INSTRUCTIONS (NOTES) — ALIGN FIRST CHARACTER UNDER THIS ARROW — 6 LINES INCH

THE HISTORY OF TECHNOLOGY

prepared by

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Dr. Vincent C. D'Ambrosio, SUNY at Oswego
Mr. Chet Ferry, Spencerport BOCES

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INSTRUCTIONS (NOTES)

INTRODUCTION

The History of Technology course has been developed as a course within the Technology Education Program at the secondary level in New York State.

The course will be offered as an elective for students in grades 9 to 12 as part of the Technology Education Sequence.

The information included in the course is based on the course outline developed as part of the occupational education and practical arts education futuring activity conducted by the New York State Education Department.

The study of the history of technology is very important to the understanding of the technologies available to our present society. It is of further importance to students as they prepare for life in the future.

The History of Technology course will enable the student to develop an awareness of where we were and why, where we are now and why, and where we are going and why.

Module Instruction Format

The History of Technology course is composed of eight modules. It is recommended that all students complete Modules 1, 2, 3, and 8, and one or more of Modules 4, 5, 6, and 7. (See Figure 1.) The decision by schools to select one or more of Modules 4, 5, 6, and 7 will depend upon:

1. available facilities, equipment, materials, etc.
2. whether the instructor uses all the recommended material in each of the four modules.
3. time devoted to teaching the History of Technology course.

The History of Technology instructor may also choose to combine Module 7, Development of Energy Production Systems, with Module 5, Development of Production Systems.

Content Outline

The History of Technology content outline has been developed in more depth than the content outline of other Technology Education courses. This was done to give the History of Technology instructor a broader and deeper understanding of the content to be included while teaching the course. The additional information is also supplied because no such other course has been offered as part of the New York State Education Department's occupational education and practical arts education programs. Therefore, the additional information would be helpful to the Technology Education personnel who will be teaching the course.

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HISTORY OF TECHNOLOGY

INSTRUCTIONAL FORMAT

Module 1 -- Development of Technology

Module 2 -- Development of Resources

Module 3 -- Systems Development

Module 4 Development of Transportation Systems	Module 5 Development of Production Systems	Module 6 Development of Communication and Information Systems	Module 7 Development of Energy Production Systems

Module 8 -- Impact of the Development of Technology on the Human Race

Figure 1.

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Time Line and Module Activities

The development of a Time Line should begin in Module 1 and continue through the study of Module 7.

The student and instructor activities for Module 2 through Module 7 should be discussed and displayed as they relate to Time Line.

Teaching the Use of Tools, Equipment and Supplies

The content outline for this course does not include information for teaching of manipulative skills. Therefore, it will be necessary for the Technology Education personnel teaching the History of Technology course to include in the teaching of the course, as needed, the safe use of tools, equipment and supplies. The instructor will also have to insure the availability of a safe working environment when appropriate to the completion of module activities.

History of Technology Personnel and Background

This course should be taught by Technology Education personnel who have an interest in and an understanding of the historical development of Technology.

It is strongly recommended that the Technology Education personnel teaching this course read and be familiar with the resources identified below to gain further insights concerning content, instructional strategies, student activities and resources.

1. American Industrial Arts Association. Technology Education: A Perspective on Implementation. Reston, VA: American Industrial Arts Association, 1985.

2. Barrier, Lynn P., Hughes, Jr., Thomas A., Letterton, Marshall O., and Van Dyke, Arvid W. Contemporary Approaches for Teaching Technology. Reston, VA: American Council of Industrial Arts Supervisors, April, 1983.

3. Hindle, Brooke. America's Wooden Age: Aspects of Its Early Technology. Tarrytown, NY: Sleepy Hollow Restorations, 1975.

4. Hindle, Brooke. Technology in Early America. Chapell Hill, NC: The University of North Carolina Press, 1966.

5. Hounshell, David A. (Ed.). The History of American Technology: Exhilaration or Discontent? Wilmington, DE: Hagley Museum and Library, 1984.

6. Hudson, Kenneth. A Guide to the Industrial Archaeology of Europe. London: John Baker, 1971.

7. Hudson, Kenneth. Handbook for Industrial Archaeologists. London: John Baker, 1967.

8. Hudson, Kenneth. Industrial Archaeology. London: John Baker, 1976.

9. Hudson, Kenneth. World Industrial Archaeology. Cambridge, London: Cambridge University Press, 1979.

10. Maley, Donald. The Maryland Plan, The Study of Industry and Technology in the Junior High School. New York: Bruce, 1973. (For information pertaining to the anthropological approach.) (Also any other writings pertaining to the anthropological approach and the Unit Method of Teaching.)

11. Maley, Donald. Teaching the Heritage of Technology: Past, Present, and Future. The Technology Teacher. Vol. 43, No. 3, December 1983, pp. 3 to 7.

12. Olson, Delmar W. Industrial Arts and Technology. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1963 (Chapter III, American Industry: A Perspective, pp. 61 to 94.)

13. Parnell, J.P.M. Techniques of Industrial Archaeology. Newton Abbott, Great Britain: David and Charles, 1974.

14. Stramer, G.H. Uses of Industrial Archaeology in Schools. Eastlands, Rugby, Great Britain: Lancaster Polytechnic, no date.

15. Tolfer, Kenneth. All of his books.

16. Others:
Any books dealing with the History of Technology such as:
Daumas -- A History of Technology and Invention
Singer -- A History of Technology
Williams -- A Short History of Twentieth Century Technology
Pursell -- Technology in America: A History of Individuals and Ideas

Resources for Course

Resources for each module may be found at the end of the module. The History of Technology instructor should also review the following publications to locate additional resources for the teaching of the historical development of technology.

1. American Industrial Arts Association. Resources in Technology Series. The Technology Teacher.

2. American Industrial Arts Association Special Services Committee. Media Resources for Technology Teachers. Reston, VA: American Industrial Arts Association, 1984.

3. McCrory, David L. and Maughan, George R. Resources in Technology. Worcester, MA: Davis Publications, Inc., 1984.

4. Ullery, Robert J. Bibliography of Reference Books for Selected Technology Fields. Albany, NY: NYSED, 1984.

Course Title Revision

The title, "The History of Technology" may not be an appropriate title for this course. The course, as proposed, actually reflects the evolution of the development of technology. It may be more appropriate to call this course, "The Evolution of Technology."

Course Content Revision

The information to be taught will need to be revised to reflect the content areas from the 7th and 8th grade Technology Education courses. This revision is necessary so as not to confuse students about the systems they learned of in the earlier courses.

One area of revision will be the need to reflect Bio-Medical systems as identified at the 7th and 8th grade level.

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INSTRUCTIONS (NOTES)

PHASE - Development ELEMENT - History of Technology

MODULE NO. 1 Development of Technology

TOPICS: Definition of Technology
Technology and Its Relationship to the Human Race
Major Technological Developments and Their Impact
Technology Time Line

PREREQUISITES: None

prepared by

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Mr. Chet Ferry, Spencerport BOCES

TOTAL TEACHING TIME - 1 Week DATE: December 1984

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MODULE: Development of Technology

OVERVIEW OF THE MODULE

Goal:

The student will be able to develop and demonstrate an understanding of the historical development of technology and its relationship to the advancement of the Human Race.

Description:

This is the introductory module for the study of the history of technology. The students will be presented with an overview of the historical development of technology. The instructor will present information identifying major technological developments and their impact on the advancement of the Human Race. Students will be shown how to develop a time line to illustrate the major technological developments found in text readings and identified and discussed in class.

Skills, knowledges, behaviors to be developed:

The student will be able to develop the ability to:

1. explain the development of technology.
2. discuss and demonstrate the relationship of technology to the development of the Human Race.
3. identify and discuss major technological developments and their impact on Human Kind.
4. prepare a Technology Time Line.

CONTENT OUTLINE

1.1 Definition of Technology

1.2. Technology and Its Relationship to the Human Race
- 1.2.1 Humans have always used technology
- 1.2.2 People change technology; technology changes people

1.3 Major Technological Developments and Their Impact
- 1.3.1 Development of technology
  - 1.3.1.1 How and why new technologies emerge, work and subside
  - 1.3.1.2 Discovery/invention/need
  - 1.3.1.3 Social/political/economic events
- 1.3.2 Technological developments
  - 1.3.2.1 World-wide
  - 1.3.2.2 The United States
  - 1.3.2.3 New York State

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MODULE: Development of Technology 2

1.4 Technology Time Line
- 1.4.1 Dawn of Civilization to Pre-Industrial Revolution
- 1.4.2 Industrial Revolution to Present
- 1.4.3 Future Projections

PERFORMANCE OBJECTIVES/SUPPORTING COMPETENCIES

1. The student will be able to develop an understanding of the term Technology. This will be accomplished by:
   a. reviewing and analyzing the application of the term in major Technology resources
   b. preparing a definition of the term for discussion in class

2. The student will be able to discuss the relationship of Technology to the development of the Human Race. This will be accomplished by:
   a. explaining the relationship of technology to the development and advancement of the Human Race
   b. explaining the effects of the changes of technology on people

3. The student will be able to identify and discuss major technological developments and their impact on the Human Race. This will be accomplished by:
   a. explaining the development of technology
   b. explaining the how and why of the emergence of new technologies
   c. identifying major technological developments and describing their impact--
      1) world-wide
      2) on the United States
      3) in New York State

4. The student will be able to describe the stages and events in the development of Technology from early civilization through present times and describe future projections. This will be accomplished by:
   a. developing a time-line to illustrate the history of technological developments
   b. developing a time-line to illustrate the historical development of--
      1) Transportation Systems
      2) Production Systems
      3) Communication and Information Systems
      4) Energy Production Systems
   c. developing a time-line to illustrate the historical development of any device that has helped the advancement of the Human Race

SUGGESTED INSTRUCTIONAL STRATEGIES

This listing of instructional strategies includes ideas as to how students may achieve the module's performance objectives. They are numbered according to their relationship with the module's performance objectives/ supporting competencies.

1. a. Instructor will present introductory presentation as to the importance of the study of the evolution of technology.
   b. Students will be assigned task to read and analyze information about the application and use of the term "Technology".
   c. Instructor will present lesson defining the term "Technology" and related terms and concepts such as inventions, discovery, tools, resources, skills, values, change, leisure time.
   d. Students will participate in the discussion of their understanding of the term "Technology" and related terms and concepts. This discussion will lead to definitions that will describe the terms as they will be used by the class in all the modules for Study of the History of Technology.

2. a. Instructor will present lessons introducing concepts of technology and their relationships on people. For example:
      Human's gaining control over nature;
      creation of environment and culture
      Production of goods and services
      Creation of leisure time activities
   The instructor will explain the relationship of technology to the Human Race and the effects of the changes of technology on people.
   b. Students will discuss/debate issues of technology and effects on people.
   c. Students will participate in role-play activity (worker's role, beliefs, work setting, leisure time activities, values, etc., pertaining to past, present and future).
   d. Students will participate in role-play activity of people who are in control of natural resources, environmental protection, etc.
   e. Students will explain, describe, identify and define in class discussion the effects of technology on the Human Race.
   f. Illustrate on a map of the world, a map of the United States, and/or a map of New York State the location of:
      1) natural resource centers
      2) manufacturing centers
      3) centers of invention and discovery
      4) population center
      5) distribution centers for manufactured goods, etc.
      6) others as identified by instructor

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INSTRUCTIONS (NOTES)

MODULE: Development of Technology 4

3. a. Instructor will explain the effects of the changes of technology on people through the use of examples such as the wheel, fire, the telephone, the computer, the splitting of atoms, development of penicillin.

b. Students will read and prepare a report of the effects of a major technological development on the Human Race and/or on them. Instructor will supply list of topics and resources to be used to complete task.

c. Instructor will demonstrate and explain the concept of the emergence of new technologies and the reason for the development of new technologies.

d. Instructor, keeping in mind students' backgrounds to date, will assign a problem asking the students to plan, design and construct an apparatus that can be used to solve the problem. Students will be asked to discuss understanding of technologies used and how the problem may have been solved if other technologies existed.

e. Students will prepare a collection of illustrations of major technological developments with a short description of their impact world wide, on the United States and on New York State.

4. a. Students will prepare a listing of major inventions, technological developments, and social, political and economic events. This will be accomplished by :

1) completed assigned readings
2) visiting a museum and/or historical site
3) viewing films such as Inheritance

Instructor must emphasize that technological developments did not occur in a vacuum. There is a direct relationship between technological developments and the social, political and economic events of the society in existence at the time of the technological development.

b. Instructor will determine the format for student involvement in the development of a Time Line to illustrate the history of technological developments and the relationship of these developments to the events of the development of the Human Race. Students may be asked to prepare a mural, a bulletin board, a photo or picture display, a collection of models, etc.

c. Guest lecturer could be asked to present a demonstration on a specific technology and talk about the evolution of that technology. For example, a blacksmith, a weaver, a carpenter, a pharmacist.

d. The class develops a Time-Line that will do one or more of the following:

1) Illustrate the history of technological developments in general.

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INSTRUCTIONS (NOTES)

MODULE: Development of Technology 5

2) Illustrate the historical development of
   a) Transportation Systems (See Module 4.)
   b) Production Systems (See Module 5.)
   c) Communication and Information Systems (See Module 6.)
   d) Energy Production Systems (See Module 7.)
3) Illustrate the historical development of a specific device that helped the advancement of the Human Race.

NOTE: This activity should begin in Module 1 and continue through Module 7.

e. Instructor may ask students to bring in news items from newspapers and magazines to predict future developments and place these on the time line (See Module 8).

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INSTRUCTIONS (NOTES)

PHASE - Development — ELEMENT - History of Technology

MODULE NO. 2 Development of Resources

TOPICS:
- Identification of Resources
- People
- Tools and Machines
- Knowledge and Information
- Capitol
- Materials
- Energy

PREREQUISITES

prepared by

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TOTAL TEACHING TIME - 3 Weeks — DATE: December 1984

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MODULE: Development of Resources 1

OVERVIEW OF MODULE

Goals:

The student will be able to develop and demonstrate an understanding of the major resources needed for the development of technology.

Description:

The development of Technology throughout history was made possible because of available resources.

To appreciate the development of Technology, it is necessary to be able to identify the resources needed for technological advancement, the historical development of these resources, and their contributions to the advancement of technological growth throughout the history of the Human Race.

Skills, knowledge, behaviors to be developed:

The student will be able to:

1. identify the major resources needed for technological development.
2. explain the role of people for technological development.
3. identify the major contributors to technological development and discuss their contributions.
4. identify, explain and demonstrate significant tool and machine developments and their relationship to technological development.
5. describe the role of knowledge and information for technological development.
6. describe the role of capitol for technological development.
7. describe the role of available materials for technological development.
8. describe the role of energy for technological development.

CONTENT OUTLINE

2.1 Identification of Resources
- 2.1.1 People
- 2.1.2 Tools and Machines
- 2.1.3 Knowledge and Information
- 2.1.4 Capitol
- 2.1.5 Materials
- 2.1.6 Energy

2.2 People
- 2.2.1 Role of People for Technological Development
  - 2.2.1.1 Inventors/discoverers
  - 2.2.1.2 Labor force
  - 2.2.1.3 Consumers
  - 2.2.1.4 Entrepreneur
- 2.2.2 Major contributors to technological advancement

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MODULE: Development of Resources 2

2.3 Tools and Machines
- 2.3.1 Significant tool developments
  - 2.3.1.1 Major types and uses
  - 2.3.1.2 Evolution
  - 2.3.1.3 Comparison of early tools with present day tools
  - 2.3.1.4 Future projections
- 2.3.2 Significant machine developments
  - 2.3.2.1 Major types and uses
  - 2.3.2.2 Evolution
  - 2.3.2.3 Comparison of early machines with present day machines
  - 2.3.2.4 Future projections

2.4 Knowledge and Information
- 2.4.1 Definition
  - 2.4.1.1 Knowledge
  - 2.4.1.2 Information
- 2.4.2 Types and effect on technological advancement
  - 2.4.2.1 Scientific
  - 2.4.2.2 Social
  - 2.4.2.3 Political
  - 2.4.2.4 Economic
  - 2.4.2.5 Religious
- 2.4.3 Development of knowledge and information
  - 2.4.3.1 The need to know more
    - 2.4.3.1.1 Why?
    - 2.4.3.1.2 Affect on technological advancement
  - 2.4.3.2 Transferring and retaining technical knowledge
    - 2.4.3.2.1 Early techniques
    - 2.4.3.2.2 Development of information storage systems
      - 2.4.3.2.2.1 spoken word
      - 2.4.3.2.2.2 written language
      - 2.4.3.2.2.3 mathematical/scientific/ mechanical instruments
        - -- rule
        - -- abacus
        - -- slide rule
        - -- others
      - 2.4.3.2.2.4 maps and charts
      - 2.4.3.2.2.5 architectural/mechanical drawings
      - 2.4.3.2.2.6 books
      - 2.4.3.2.2.7 memory systems--computer

2.5 Capitol
- 2.5.1 Beginning of economic system

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MODULE: Development of Resources 3

2.5.2 Purchasing goods and services
- 2.5.2.1 Early use
  - 2.5.2.1.1 Barter
    - 2.5.2.1.1.1 goods
    - 2.5.2.1.1.2 labor
  - 2.5.2.1.2 Monetary
    - 2.5.2.1.2.1 gold
    - 2.5.2.1.2.2 coins
    - 2.5.2.1.2.3 paper money
- 2.5.2.2 Today
  - 2.5.2.2.1 Monetary
    - 2.5.2.2.1.1 coins
    - 2.5.2.2.1.2 paper money
    - 2.5.2.2.1.3 checks
    - 2.5.2.2.1.4 credit cards
  - 2.5.2.2.2 Barter
    - 2.5.2.2.2.1 labor
    - 2.5.2.2.2.2 goods

2.5.3 Development of monetary system
- 2.5.3.1 Coinage
  - 2.5.3.1.1 Early coins
  - 2.5.3.1.2 Today
- 2.5.3.2 Paper money
  - 2.5.3.2.1 Early use
  - 2.5.3.2.2 Today
- 2.5.3.3 Plastic money
  - 2.5.3.3.1 Credit cards
  - 2.5.3.3.2 Cash cards
  - 2.5.3.3.3 Smart cards
- 2.5.3.4 Electronic transfer

2.6 Materials

2.6.1 Evolution of material processing
- 2.6.1.1 Stone Age
- 2.6.1.2 Bronze Age
- 2.6.1.3 Iron Age

2.6.2 Natural raw material processing
- 2.6.2.1 Extractive
  - 2.6.2.1.1 Clays
  - 2.6.2.1.2 Ores
    - 2.6.2.1.2.1 ferrous
    - 2.6.2.1.2.2 non-ferrous
  - 2.6.2.1.3 Limestone
  - 2.6.2.1.4 Coal
  - 2.6.2.1.5 Oil
  - 2.6.2.1.6 Minerals-miscellaneous
  - 2.6.2.1.7 Others

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'STRUCTIONS (NOTES)

MODULE: Development of Resources 4

2.6.2.2 Genetic
2.6.2.2.1 Farming--Food Production
2.6.2.2.2 Animal hide
2.6.2.2.3 Cotton
2.6.2.2.4 Wool
2.6.2.2.5 Lumbering
2.6.2.2.5.1 wood
2.6.2.2.5.2 naval stores
2.6.2.2.6 Oil
2.6.2.2.6.1 plant
2.6.2.2.6.2 animal

2.6.3 Processed raw materials and synthetics
2.6.3.1 Chemicals
2.6.3.2 Clays
2.6.3.3 Fabrics
2.6.3.3.1 Natural
2.6.3.3.1.1 wool
2.6.3.3.1.2 cotton
2.6.3.3.1.3 others
2.6.3.3.2 Synthetic
2.6.3.4 Food
2.6.3.4.1 Grains
2.6.3.4.2 Meats
2.6.3.4.3 Fruits
2.6.3.4.4 Vegetables
2.6.3.4.5 Milk
2.6.3.4.6 Others
2.6.3.4.6.1 honey
2.6.3.4.6.2 sugars
2.6.3.4.6.3 salt
2.6.3.4.6.4 others
2.6.3.5 Glass
2.6.3.6 Leather
2.6.3.7 Lumber
2.6.3.8 Metals
2.6.3.8.1 Ferrous
2.6.3.8.2 Non-ferrous
2.6.3.9 Minerals--miscellaneous
2.6.3.10 Oil
2.6.3.11 Paper
2.6.3.12 Polymers
2.6.3.12.1 Fabric
2.6.3.12.2 Non-fabric
2.6.3.13 Others

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MODULE: Development of Resources 5

2.7 Energy
- 2.7.1 Early sources of power
  - 2.7.1.1 Evolution
  - 2.7.1.2 Types
    - 2.7.1.2.1 Human
    - 2.7.1.2.2 Animals
    - 2.7.1.2.3 Water and wind
- 2.7.2 Later sources of power
  - 2.7.2.1 Evolution
  - 2.7.2.2 Types
    - 2.7.2.2.1 Steam
    - 2.7.2.2.2 Electricity
    - 2.7.2.2.3 Internal combustion engine
    - 2.7.2.2.4 Solar
    - 2.7.2.2.5 Nuclear
- 2.7.3 Energy storage
- 2.7.4 Energy/power transmission

PERFORMANCE OBJECTIVES/SUPPORTING COMPETENCIES

1. The student will be able to identify and describe the six major resources necessary for technological development. This will be accomplished by:
   a. Preparing a listing of the resources needed for technological development as identified in major technology resources and by instructor.

2. The student will be able to discuss the major roles that people have played in the development of technology. This will be accomplished by:
   a. Explaining the role of inventors/discoverers in the development of technology.
   b. Explaining the role of the labor force in the development of technology.
   c. Explaining the role of the consumer in the development of technology.
   d. Explaining the role of the entrepreneur in the development of technology.

3. The student will be able to identify people who were the major contributors to the advancement of technology and discuss their contributions. This will be accomplished by:
   a. Identifying major male contributors and explaining their contributions.
   b. Identifying major female contributors and explaining their contributions.
   c. Identifying major contributions made by individuals from major racial and cultural groups and explaining their contributions.

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MODULE: Development of Resources 6

4. The student will be able to discuss significant tool developments that have contributed to technological advancement. This will be accomplished by:
   a. Identifying major tool types and uses.
   b. Describing the evolution of selected tools.
   c. Comparing early tools with present tools (design, cutting edge, use).
   d. Assessing contemporary tools and discussing their possible design and use in the future.

5. The student will be able to discuss significant machine developments that have contributed to technological advancement. This will be accomplished by:
   a. Identifying major machine types and uses.
   b. Describing the evolution of selected machines.
   c. Comparing early machines with present machines (design, cutting edge, use).
   d. Assessing contemporary machines and discussing their possible design and use in the future.

6. The student will be able to display an understanding of the terms knowledge and information. This will be accomplished by:
   a. Defining the term knowledge.
   b. Defining the term information.

7. The student will be able to identify the five major types of knowledge and information, and describe their effect on technological advancement. This will be accomplished by:
   a. Listing the five major types of knowledge and information.
   b. Citing examples of each.
   c. Discussing their effect, positive and negative, on technological advancement.

8. The student will be able to display an understanding of the affect of needing to know more has had on the development of technology. This will be accomplished by:
   a. Explaining the inquisitive nature of the human being.
   b. Describing the effect of the inquisitive nature of the human being on technological advancement.

9. The student will be able to describe and demonstrate the effect of transferring and retaining technical knowledge has had on the development of technology. This will be accomplished by:
   a. Discussing the development of information storage systems for the transferring and retaining of technical knowledge.
   b. Demonstrating expertise in the methodologies for transferring and retaining technical knowledge from early technologies through present day memory systems operation.

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MODULE: Development of Resources 7

10. The student will be able to analyze the relationship between capitol and the development of technology. This will be accomplished by:
    a. Describing the evolution of an economic system.
    b. Describing and demonstrating how earlier barter systems were used to purchase goods and services.
    c. Describing and demonstrating how the barter system is used today to purchase goods and services.
    d. Identifying and explaining type of monetray systems used prior to 1945.
    e. Identifying and explaining type of monetary systems used since 1945.
    f. Tracing the development of monetary system from early times to the present.
    g. Describing and practicing the purchase of goods and services using earlier monetary system.
    h. Describing and practicing the purchase of goods and services using contemporary monetary system.
    i. Discussing the relationship of the use of the barter system to technological development.
    j. Discussing the relationship of the use of a monetary system to technological development.

11. The student will be able to describe the evolution of material processing during various historical eras. This will be accomplished by:
    a. Identifying materials used during the Stone Age, explaining how they were processed and used, and discussing their relationship to developing technologies.
    b. Identifying materials used during the Bronze Age, explaining how they were processed and used, and discussing their relationship to developing technologies.
    c. Identifying materials used during the Iron Age, explaining how they were processed and used, and discussing their relationship to developing technologies.

12. Students will be able to identify, discuss and demonstrate the application of natural raw materials processing of materials obtained by extractive methods. This will be accomplished by:
    a. Identifying the raw materials derived from various extractive processes.
    b. Describing the processes used to extract raw material from the earth.
    c. Identifying and describing the use of tools and machines used to extract raw materials from the earth.
    d. Performing an extractive process. For example:
        1) Obtaining raw clay from a local site (will be processed later for use as either casting slip or modeling clay. See Module 5).
        2) Preparing a rock collection of minerals indigent to local area.

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MODULE: Development of Resources 8

3) Preparing a rock collection of minerals common to New York State.

e. Identifying local quarrying or mining sites and discussing the way materials were removed from the earth.

13. Students will be able to identify, discuss and demonstrate the application of natural raw material processing of materials obtained by genetic methods. This will be accomplished by:

a. Identifying the raw materials derived from various genetic processes.

b. Describe the processes used to produce genetic raw materials.

c. Identifying and describing the use of tools and machines used to obtain genetic raw materials.

d. Performing a genetic process. For example:

1) Planning, growing and harvesting a Heirloom Vegetable Garden.
2) Gathering maple sap.
3) Skinning a deer or lamb to obtain hide.
4) Shearing sheep and cleaning wool.
5) Assisting in the thinning and prunning of small wood lot.
6) Planting trees as part of Arbor Day, Scouting, 4-H and/or Cooperative Extension Activity.
7) Milking a cow or goat.
8) Extracting aromatic oil from cedar leaves.

14. The student will be able to describe and demonstrate the processing of natural raw materials and synthetics into secondary materials or finished products. This will be accomplished by:

a. Describing the processing of raw materials and synthetics into secondary materials or finished products. For example:

1) Production of steel
2) Production of aluminum
3) Manufacturing of plywood
4) Manufacturing of particle board
5) Making bricks
6) Making glass
7) Making paper
8) Making maple syrup
9) Making soap and adding aromatic cedar oil for scent
10) Making cheese
11) Making butter
12) Preserving food -- canning
-- freezing
-- drying
-- curing
13) Processing deer hide or lamb skin
14) Making yarn from wool, cotton, other materials

b. Processing raw materials following a prepared plan supplied by instructor. For example:
   1) Chemicals -- Produce a polymer material
      -- Produce potash
   2) Clay -- Process extracted clay into either casting slip or modeling clay
      -- Manufacture bricks
   3) Fabrics -- Use raw wool to produce yarn
      -- Use raw cotton to produce yarn
      -- Use other materials to produce yarn
   4) Food --
      -- grains---grind oats or corn into meal
      -- meats--- cure hams
      --- make jerkey from beef or venison
      -- fruits---dry fruit using solar dehydrator
      -- vegetables---preserve by canning, freezing, drying
      -- milk---make cheese
   5) Glass -- Make glass
   6) Leather -- Tan deer hide or lamb skin
   7) Lumber -- Process a log
      -- Make plywood
      -- Make particle board
   8) Metals -- Not recommended due to EPA Standards
   9) Minerals -- Making glass
      -- Making gems for jewelry
   10) Oil -- Use aromatic cedar oil for scent when making soap
   11) Paper -- Make paper using pulp obtained from paper manufacturer
      -- Make paper using corn stalks or milkweed
   12) Polymers -- Not recommended due to cost
   13) Others -- Making soap
      -- Making walnut stain from black walnuts

15. The student will be able to discuss and demonstrate significant energy developments that have contributed to technological advancement. This will be accomplished by:
   a. Identifying types of early sources of power.
   b. Identifying types of later sources of power.
   c. Describing the evolution of energy sources.
   d. Describing the evolution of energy storage.
   e. Describing the evolution of energy transmission.
   f. Developing a device to produce electricity using:
      1) Chemical process
      2) Mechanical generation
      3) Solar energy
   g. Developing a device to store energy
   h. Developing a device to transmit energy or power.

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INSTRUCTIONS (NOTES)

3) Females who made major contributions.
4) Blacks who made major contributions.
5) Individuals of other racial and cultural groups who made major contributions.

d. If time permits, students may be asked to select one of the contributors identified in "c" and write a one page report concerning contribution.

e. Students will assist in obtaining models, toys and pictures of some of the inventions identified completing the tasks identified in "c".

f. Visit museum, historical site, etc., to obtain information concerning topic.

4. a. Using models, examples, selected reading references, films, filmstrips, and slides, instructor will introduce students to significant tool developments.

b. Students will complete instructor prepared instructional activity sheets:
1) Identification of major tool types and uses.
2) Evolution of selected tool during different time periods.
3) Comparison of early tools with present-day tool.
a) design
b) cutting edge
c) use
4) Selection of a present day tool and discussing future design and application.

c. View films depicting craftspeople using tools.

d. Read selected references.

e. Following safe working procedures, construct an example of an early tool. For example:
1) Marking gauge
2) Scriber
3) Compass
4) Chisel
5) Plane

f. Use tool (see "e") to perform a process typical to that tool.

g. Assist instructor in preparing an exhibit of hand tools comparing present day tools with earlier tools.

h. Visit to museum, historical site, etc., to obtain information concerning topic.

5. a. Using models, examples, selected reading references, films, filmstrips, and slides, instructor will introduce students to significant machine developments.

b. Students will complete instructor prepared instructional activity sheets:
1) Identification of major machine types and uses.
2) Evolution of selected machines during different time periods.
3) Comparison of early machines with present day machines.
4) Selection of a present day machine and discussing future design and application.

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SUGGESTED INSTRUCTIONAL STRATEGIES

This listing of instructional strategies includes ideas as to how the students may achieve the module's performance objectives. They are numbered according to their relationship with the items identified as performance of objectives/supporting competencies.

1. a. Instructor will present a lesson introducing students to the types of resources necessary for technological development.
   b. Students will read selected reference(s), identify the six major types of resources, and discuss how these six types will be referred to in Modules 2 to 8.

2. a. Students will list the four major groups of people who have contributed to technological growth, prepare a paragraph stating what each group contributes to technological growth, and discuss their list and statements in class where instructor will assist students in developing an understanding the role that people play in the development of technology.
      1) View film(s)
         a) Colonial Williamsburg series
         b) Inheritance
         c) Others
      2) Role of inventors/discovers
      3) Role of labor force
      4) Role of consumer
      5) Role of entrepreneur
   b. Visit museum, historical site, etc., to obtain information concerning topic.

3. a. Using selected references, films, filmstrips, and slides, instructor will introduce students to people who were the major contributors to the advancement of technology and discuss their contributions.

      Instructor must identify both male and female contributors, white and non-white contributors, and contributors from other cultural and racial backgrounds. There is a great deal of information available for this topic and so there should be no concern about finding information.
   b. During discussion of instructor's presentation, students will be asked to assist in preparing a listing of major contributors. The instructor will then present the next item ("c") to the class.
   c. Students will complete instructor prepared instructional activity sheet identifying:
      1) Major contributors during different time periods.
      2) Individuals who contributed to the development of:
         a) Transportation Systems
         b) Production Systems
         c) Communication and Information Systems
         d) Energy Systems

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INSTRUCTIONS (NOTES) ALIGN FIRST CHARACTER UNDER THIS ARROW 6 LINES INCH

c. View films depicting use of machines.
d. Read selected references.
e. Following safe working procedures, construct an example of an early machine.
f. Use machine (see "e") to perform a process typical to that machine.
g. Assist instructor in preparing an exhibit of pictures of machines comparing present day machines with earlier machines.
h. Visit museum, historical site, etc., to obtain information concerning topic.
i. Discuss in class the use of robotics, computers and lasers for manufacturing production comparing production using these devices to production without the use of these devices.

6. a. Instructor will present a lesson defining the terms "knowledge" and "information".
b. Students will discuss the use of these terms as they apply to this module and to Modules 3 to 8.

7. a. Instructor will present a lesson identifying the five major types of knowledge and information and examples of each and explain their effect, positive and negative, on technological advancement.
b. Students using selected references, instructor's presentation, films, filmstrips, and slides, will complete instructor prepared instructional activity sheet:
1) List the five major types.
2) Cite example of each and discuss the effect, positive and negative, on technological development.
c. Visit museum, historical site, etc., to obtain information concerning topic.

8. a. Instructor will explain, using selected readings and films, etc., that humans have always had an inquisitive nature and the effect this has had on technological advancement.
b. Students will discuss the inquisitive nature of human beings and will be asked if they have ever solved a problem differently than from a solution given to them by others. Did this happen because of their inquisitive nature and thinking there may be more than one way to do something and do it efficiently and in shorter time?
c. Visit museum, historical site, etc., to obtain information concerning topic.

9. a. Using information presented by instructor, reading of selected references, and viewing films, etc., students will discuss how information storage systems were developed for the transferring and retaining of technical knowledge.

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INSTRUCTIONS (NOTES)

b. As part of the activity students could be asked to develop a simple information storage system:
   1) Information of how to get from one location to another.
   2) Information of how to construct a house.
   3) Information of how to wash clothes.

c. Discuss the effect of social, political and economic events that might hinder or help the retaining and transferring of knowledge. For example:
   1) Events leading to the Dark Ages.
   2) Events leading to the Renaissance.
   3) Effect of World War II
   4) Effect of space exploration
   5) Effect of Depression of 1929
   6) Effect of economic climate of the 1970's and 1980's

d. Demonstrate ability to use different methods of transferring and retaining knowledge and information. For example:
   1) Drawing maps
   2) Constructing charts and graphs
   3) Drawing plans for constructed structures
   4) Drawing plans for manufactured products
   5) Using measuring devices
   6) Using scientific equipment
   7) Using microcomputer

e. Visit to local industry and/or business that makes extensive use of knowledge and information systems.

f. Interview manager of knowledge and information systems.

g. Visit to museum, historical site, etc., to obtain information concerning topic.

10. a. Using information presented by instructor, reading selected references, and viewing films, etc., students will discuss the evolution of an ecomonic system.

b. Students will participate in instructor developed role playing situations involving the use of earlier barter systems and present day barter systems, and discuss differences and similarities. Students should bring to class items to be traded with other students during the role playing activity.

c. Using information found in selected references students will trace the development of monetary systems from early times to present and identify and explain type of monetary system used prior to 1945 and since 1945. Information will be added to Time Line begun in Module 1.

d. Students will participate in role playing activity involving the purchase of goods and services using earlier monetary system and contemporary monetary system and discuss differences and similarities.

e. Using information presented by instructor and reading selected references, students will discuss the relationship between the use of the barter system and the development of technology.

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f. Using information presented by instructor and reading selected references, students will discuss the relationship between the use of a monetary system and the development of technology.

g. Instructor will make arrangements for:
1) Visit to banking institution and other economic institution.
2) Speaker from banking and other economic institutions.

11. a. Using selected references, students will prepare a listing of materials used by people of the Stone Age. For each material identified students will:
1) Explain how they were obtained.
2) Explain how they were processed into a useful item.
3) Make some of the items and demonstrate how to use the item to perform a useful function. For example, constructing a shelter using simple tools.
4) Discuss the role the item played in helping to develop a technology.
5) Add information to Time Line.

b. Using selected references, student will prepare a listing of materials used by people of the Bronze Age. For each material identified students will:
1) Explain how they were obtained.
2) Explain how they were processed into a useful item.
3) Make some of the items and demonstrate how to use the item to perform a useful function.
4) Discuss the role the item played in helping to develop a technology.
5) Add information to Time Line.

c. Using selected references, student will prepare a listing of materials used by people of the Iron Age. For each material identified students will:
1) Explain how they were obtained.
2) Explain how they were processed into a useful item.
3) Make some of the items and demonstrate how to use the item to perform a useful function.
4) Discuss the role the item played in helping to develop a technology.
5) Add information to Time Line.

12. a. Using information presented by instructor, reading selected references, viewing films, visiting extractive processing sites, etc., students will:
1) Identify and describe different extractive processes.
2) Identify the raw materials derived from these processes.
3) Identify and describe the use of tools and machines used to extract raw materials from the earth.

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INSTRUCTIONS (NOTES)

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b. Students will visit selected sites in community and will:
   1) Obtain raw clay by using hand tools to extract the clay.
   2) Compare method of using hand tools with use of heavy machinery to obtain clay.
   3) Obtain minerals to prepare a rock collection of minerals found in local area.

c. Students will assist instructor in identifying minerals common to New York State, locating the minerals from stock obtained from science teacher or geology supply house, and prepare an exhibit of minerals found in New York State and sample of products made from these minerals.

d. Given geological survey map of community, students will identify location of local quarrying and mining sites, and discuss in class how materials are either quarried or mined.

13. a. Using information presented by instructor, reading selected references, etc., students will:
   1) Identify different genetic methods of production.
   2) Identify the raw materials derived from the various genetic processes.
   3) Describe the processes used to produce raw materials.

b. Instructor will present necessary information and develop appropriate activity sheets so that students may perform one or more of the following genetic processes:
   1) Planning, growing and harvesting a Heirloom Vegetable Garden on land owned by school district or supplied by local land owner or farmer.
   2) Gathering maple sap from trees found on school property.
   3) Skinning a deer or lamb to obtain hide.
   4) Shearing sheep and cleaning wool.
   5) Assisting in the thinning and pruning of small wood lot.
   6) Planting trees as part of Arbor Day, Scouting, 4-H, and/or Cooperative Extention Activity.
   7) Milking a cow or goat to obtain milk to make butter or cheese.
   8) Extracting aromatic oil from cedar leaves.

Products of above genetic process activities will be used to produce agricultural products.

14. a. Using information presented by instructor, etc., students will be able to:
   1) Discuss in class the processing of raw materials and synthetics into secondary materials or finished products.
   2) Describe how steel is produced.
   3) Describe how aluminum is produced.

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INSTRUCTIONS (NOTES)

b. Instructor will present necessary information and develop appropriate activity sheets so that students may:

1) Describe how to perform one or more of the following processes:

a) manufacturing of plywood using veneers

b) manufacturing of particle board using wood chips from planer.

c) making bricks using clay obtained from local sites.

d) making glass.

e) making paper using pulp, corn stalks, or cat tails.

f) making maple syrup using sap gathered from school district trees.

g) making soap and adding aromatic cedar oil for scent.

h) making cheese using cow or goat milk.

i) making butter using cow or goat milk.

j) preserving food by canning, freezing, drying and curing.

k) processing deer hide or lamb skin.

l) making yarn from wool, cotton, other materials.

2) Select one or more of the following material areas and perform the processing of raw materials activity:

a) Chemicals--Produce a polymer material
--Produce potash

b) Clay--Process extracted clay into either casting slip or modeling clay
--Manufacture bricks

c) Fabrics--Use raw wool to produce yarn
--Use raw cotton to produce yarn
--Use other materials to produce yarn

d) Food--
--grains---grind oats or corn into meal
--meats---cure hams
---make jerkey from beef or venison
--fruits---dry fruit using solar dehydrator
--vegetables---preserve by canning, freezing, drying
--milk---make cheese

e) Glass--make glass
Leather--tan deer hide or lamb skin

f) Lumber--Process a log
--Make particle board

g) Metals--Not recommending due to EPA Standards

h) Minerals--Making glass
--Making gems for jewelry

i) Oil--Use aromatic cedar oil for scent when making soap

j) Paper--Make paper using pulp obtained from paper manufacturer
--Make paper using corn stalks or milkweed

k) Polymers--Not recommending due to cost

l) Others--Making soap
--Making walnut stain from black walnuts

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INSTRUCTIONS (NOTES)

15. a. Using information presented by instructor, reading selected references, viewing films, and pictures and models of sources of power, energy storage, energy transmission students will:
    1) Identify examples of early sources of power and describe the evolution of these devices.
    2) Identify examples of later sources of power and describe the evolution of these devices.
    3) Identify energy storage devices and describe the evolution of these devices.
    4) Identify energy transmission devices and describe the evolution of these devices.

b. Instructor will present necessary information and develop appropriate activity sheets so that students will:
    1) Develop a device to produce electricity using chemical processes.
    2) Develop a device to produce electricity using mechanical generation.
    3) Develop a device to produce electricity using solar energy.
    4) Develop a device to store energy.
    5) Develop a device to transmit energy or power.

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INSTRUCTIONS (NOTES)

PHASE - Development — ELEMENT - History of Technology

MODULE NO. 3 Systems

TOPICS: Definition of Systems
Systems Having Major Significance in Triggering Technological Change

PREREQUISITES: None

prepared by

Mr. Martin D. Collins, Baldwinsville Academy and Central School
Dr. Vincent C. D'Ambrosio, SUNY at Oswego
Mr. Chet Ferry, Spencerport BOCES

TOTAL TEACHING TIME - 2 Weeks DATE: December 1984

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INSTRUCTIONS (NOTES)

MODULE: Systems 1

OVERVIEW OF MODULE

Goal:

The student will be able to develop and demonstrate an understanding of the systems having major significance in triggering technological change and their role in the historical advancement of technology.

Description:

This module is to be used as an introduction to Modules 4, 5, 6 and 7. The students will be presented with information concerning the evolution of technology and the advancement of the Human Race through the ages from an Early Agricultural Society to an Information/Service/High Technology Society.

They will develop an understanding of how the different societies evolved due to the effect of systems and major technological developments.

Skills, knowledge, behaviors to be developed:

The student will be able to:

1. define the term systems.
2. describe the evolution of the Human Race from an Early Agricultural Society to an Information/Service/High Technology Society.
3. describe the systems that contributed to the evolution of technology and the advancement of the Human Race.
4. describe the events that contributed to the evolution of technology and the advancement of the Human Race.
5. describe the technological advancements that contributed to the advancement of the Human Race.

CONTENT OUTLINE

3.1 Definition of Systems

3.2 Systems Having Major Significance in Triggering Change
- 3.2.1 Early Agricultural Society
  - 3.2.1.1 Ploughing and tilling
  - 3.2.1.2 Irrigation
- 3.2.2 Pre-Industrial Society
  - 3.2.2.1 Folkways
  - 3.2.2.2 Early Technologies
  - 3.2.2.3 Early Crafts and Trades

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INSTRUCTIONS (NOTES)

MODULE: Systems 2

3.2.3 Industrial Society
- 3.2.3.1 Systems of the Industrial Society
- 3.2.3.2 Events Leading to the Industrial Society
- 3.2.3.3 The Role of the Craftsperson
- 3.2.3.4 Major Technological Developments

3.2.4 Post-Industrial Society
- 3.2.4.1 Systems of the Post-Industrial Society
- 3.2.4.2 Events Leading to the Post-Industrial Society
- 3.2.4.3 The Role of the Worker
  - 3.2.4.3.1 blue collar
    - 3.2.4.3.1.1 unskilled
    - 3.2.4.3.1.2 skilled
  - 3.2.4.3.2 white collar
  - 3.2.4.3.3 support personnel
- 3.2.4.4 Major Technological Developments

3.2.5 Information/Service/High Technology Society
- 3.2.5.1 Systems of the Information/Service/High Technology Society
- 3.2.5.2 Events Leading to the Information/Service/High Technology Society
- 3.2.5.3 The Role of the Worker
  - 3.2.5.3.1 blue collar
    - 3.2.5.3.1.1 unskilled
    - 3.2.5.3.1.2 skilled
  - 3.2.5.3.2 white collar
  - 3.2.5.3.3 support personnel
- 3.2.5.4 Major Technological Developments

PERFORMANCE OBJECTIVES/SUPPORTING COMPETENCIES

1. The student will be able to develop an understanding of the term Systems. This will be accomplished by:
   a. Reviewing and analyzing the application of the term in major Technology resources.
   b. Preparing a definition of the term for discussion in class.

2. The student will be able to discuss and demonstrate the relationship of systems to the evolution of technology and the advancement of the Human Race. This will be accomplished by:
   a. Identifying the systems having major significance in triggering change in the
      1) Early Agricultural Society
      2) Pre-Industrial Society
      3) Industrial Society
      4) Post-Industrial Society
      5) Information/Service/High Technology Society

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b. Identifying through the development of a time-line the events leading to the
   1) Early Agricultural Society
   2) Pre-Industrial Society
   3) Industrial Society
   4) Post-Industrial Society
   5) Information/Service/High Technology Society

c. Describing the role of the worker in the
   1) Early Agricultrual Society
   2) Pre-Industrial Society
   3) Industrial Society
   4) Post-Industrial Society
   5) Information/Service/High Technology Society

d. Describing the major technological developments of the
   1) Early Agricultural Society
   2) Pre-Industrial Society
   3) Industrial Society
   4) Post-Industrial Society
   5) Information/Service/High Technology Society

SUGGESTED INSTRUCTIONAL STRATEGIES

This listing of instructional strategies includes ideas as to how the students may achieve the module's performance objectives. They are numbered according to their relationship with the items identified as performance objectives/supporting competencies.

1. a. The instructor will present a lesson defining the term "Systems" and discussing the relationship of systems to technological developments. The instructor will also discuss how systems directly affects the lives of students in the class.

   b. Students will participate in the discussion of their understanding of the term "Systems" and its use in all the modules for the study of the History of Technology.

2. a. The instructor may present the information for this section by either presenting the type of society and discussing the four major components or by presenting the four components one at a time and discussing how they affected the individual type of society.

   The societies to be presented are:
   a) Early Agricultural Society
   b) Pre-Industrial Society
   c) Industrial Society
   d) Post-Industrial Society
   e) Information/Service/High Technology Society

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INSTRUCTIONS (NOTES)

MODULE: Systems 4

The four major components to be presented are:
a) Systems having major significance in triggering change
b) Events leading to the development of the society
c) Role of the worker in the society
d) Major technological developments of the society

b. Presentation of information using four major components

1) Instructor will describe the role that systems have had in triggering major technological development in the
a) Early Agricultural Society
b) Pre-Industrial Society
c) Industrial Society
d) Post-Industrial Society
e) Information/Service/High Technology Society
Students will compare the systems of a local industry to the systems of a comparable craftshop in Colonial America.

2) Instructor will present material on the role of the worker in the
a) Early Agricultural Society
b) Pre-Industrial Society
c) Industrial Society
d) Post-Industrial Society
e) Information/Service/High Technology Society
Instructor will describe the development of guilds, labor unions, child labor laws, OSHA. Students will select a topic for discussion in class.

3) Instructor will present material describing major technological developments of the
a) Early Agricultural Society
b) Pre-Industrial Society
c) Industrial Society
d) Post-Industrial Society
e) Information/Service/High Technology Society
Instructor will demonstrate the development of device common to each society and have students produce. For example: The Production of a scoop.
a) Early Agricultural Society--Carve a wooden scoop
b) Pre-Industrial Society--Produce a sheetmetal scoop using hand forming methods
c) Industrial Society--Producing a sheetmetal scoop using an example of a drop-forge press
d) Post-Industrial--Producing a plastic mold scoop
Have students view film, Inheritance, and compare how the following were made then and now:
a) shovels
b) baskets
c) sheetmetal items
d) wrought iron items

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INSTRUCTIONS (NOTES)

MODULE: Systems — 5

4) Instructor will discuss events leading to the
   a) Early Agricultural Society
   b) Pre-Industrial Society
   c) Industrial Society
   d) Post-Industrial Society
   e) Information/Service/High Technology Society
   Instructor will describe the social/political/economic events of the time period and have the students compare the events with events occurring today.

c. Presentation of information using the five types of societies
   1) Instructor will identify different societies that represent different time periods of the evolution of the advancement of the Human Race.
      a) Early Agricultural Society
      b) Pre-Industrial Society
      c) Industrial Society
      d) Post-Industrial Society
      e) Information/Service/High Technology Society
      For each of the identified societies the instructor will
      a) a) Describe the role that systems have had in triggering major technological development
      b) Identify the type of worker found in that society and describe the role of the worker in that society
      c) Identify and describe the major technological development of that society
      d) Describe the events leading to the development of that society

d. Examples of strategies no matter what method of presentation is used by instructor.
   1) Discussion and demonstration of food gathering/crop production/harvesting prior to, during, and after the development of ploughing, and the development of irrigation.
   2) Visit a fruit farm or a vegetable farm and observe planting, caretaking, and harvesting and compare to how done during earlier societies.
   3) Discuss how skills/trades/knowledge/information was passed on from craftsperson to apprentice.
   4) Have class visit a local industry having an apprentice program and compare to what may have existed during pre-industrial society and industrial society.
   5) Guest speakers who could address one or more of the four major components as they affected one or more of the societies.
      a) farmer or tool collector talking about types of old ploughs and comparing with today's ploughs.

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INSTRUCTIONS (NOTES)

MODULE: Systems 6

b) craftsperson talking about basketry, candlemaking, and weaving and comparing to today's mass produced items.
c) union leader talking about development of labor organizations
d) management leader discussing development of industry in the United States and/or New York State

6) Use of films to illustrate the four major components and the five types of societies.
7) Visitation to a hospital or drug store and compare with earlier time periods.
8) Visitation to farm, factory, craftsperson's workshop to view first hand what occurs in the production of a product.
9) Visitation to a museum or historical site for information on evolution of the Human Race and the effect of technological developments.
10) Producing a device using production methods common to the period. (See 2.b.3 listed above.)
11) Visitation to a site of raw materials and compare method of obtaining the raw material in one or more of the societies identified earlier.
12) Role-play activity to simulate what a worker did in each of the societies.
13) Preparation of a collection of pictures of each society.
14) Preparation of a collection of artifacts of each society.
15) Add information to Time Line started in Module 1.

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INSTRUCTIONS (NOTES)

PHASE - Development ELEMENT - History of Technology

MODULE NO. 4 Development of Transportation Systems

TOPICS: Introduction to Transportation Systems
Evolution of Transportation Systems
Inland Transportation
Sea Transportation
Air Transportation
Specialized Movement of Goods and Materials

PREREQUISITES: History of Technology
Module 1 - Development of Technology
Module 2 - Development of Resources
Module 3 - Systems

prepared by

Mr. Martin D. Collins, Baldwinsville Academy and Central School
Dr. Vincent C. D'Ambrosio, SUNY at Oswego
Mr. Chet Ferry, Spencerport BOCES

TOTAL TEACHING TIME - 0-12 Weeks DATE: December 1984

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MODULE: Development of Transportation Systems 1

OVERVIEW OF MODULE

Goal:

The student will be able to develop and demonstrate an understanding of the historical evolution of transportation systems, and the historical development of Inland Transportation, Sea Transportation, Air Transportation, and the Specialized Movement of Goods and Materials.

Description:

Students will be introduced to the historical development of the four main types of Transportation Systems. They will have the opportunity to construct models and other devices, prepare collections and perform other activities to increase their awareness of the relationship of the development of Transportation Systems to the technological advancement of the Human Race.

Skills, knowledge, behaviors to be developed:

The student will be able to:

1. identify the four main types of Transportation Systems.
2. describe the historical development of the four main types of Transportation Systems.
3. discuss and demonstrate the relationship of the development of the four main types of Transportation Systems with technological advancements.
4. discuss and demonstrate the relationship of the development of the four main types of Transportation Systems with the advancement of the Human Race.
5. construct full size and scale models of Transportation System devices.

CONTENT OUTLINE

4.1 Introduction to Transportation Systems
- 4.1.1 Definition of Transportation Systems
- 4.1.2 Types of Transportation Systems
  - 4.1.2.1 Inland Transportation
  - 4.1.2.2 Sea Transportation
  - 4.1.2.3 Air Transportation
  - 4.1.2.4 Specialized Movement of Goods and Materials

4.2 Evolution of Transportation Systems
- 4.2.1 Human Power
- 4.2.2 Animal Power
- 4.2.3 Machine Power

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STRUCTIONS (NOTES)

MODULE: Development of Transportation Systems 2

4.3 Inland Transportation
- 4.3.1 Types
  - 4.3.1.1 Sailing Vessels
  - 4.3.1.2 Canals
  - 4.3.1.3 Roads
  - 4.3.1.4 Land Vehicles
  - 4.3.1.5 Railroads and Equipment
  - 4.3.1.6 Bridges
  - 4.3.1.7 Mass Transit
- 4.3.2 Development
  - 4.3.2.1 Sailing Vessels
    - 4.3.2.1.1 Canal boats
    - 4.3.2.1.2 Steam boats
    - 4.3.2.1.3 Canoes
    - 4.3.2.1.4 River rafts
  - 4.3.2.2 Canals
  - 4.3.2.3 Roads
    - 4.3.2.3.1 Animal trails
    - 4.3.2.3.2 Dirt path
    - 4.3.2.3.3 Log and plank roads
    - 4.3.2.3.4 Cobblestone/brick
    - 4.3.2.3.5 Paved
    - 4.3.2.3.6 Concrete
  - 4.3.2.4 Land vehicles
    - 4.3.2.4.1 Sled
    - 4.3.2.4.2 Cart
    - 4.3.2.4.3 Wagon
    - 4.3.2.4.4 Carriages
    - 4.3.2.4.5 Stage coach
    - 4.3.2.4.6 Automobile
    - 4.3.2.4.7 Truck
  - 4.3.2.5 Railroads and equipment
  - 4.3.2.6 Bridges
    - 4.3.2.6.1 Beam/Girder
      - 4.3.2.6.1.1 Wood
      - 4.3.2.6.1.2 Metal
    - 4.3.2.6.2 Truss
      - 4.3.2.6.2.1 Wood
      - 4.3.2.6.2.2 Metal
    - 4.3.2.6.3 Suspension
    - 4.3.2.6.4 Cantilever
    - 4.3.2.6.5 Arch
      - 4.3.2.6.5.1 Stone
      - 4.3.2.6.5.2 Concrete
      - 4.3.2.6.5.3 Steel
    - 4.3.2.6.6 Movable
      - 4.3.2.6.6.1 Bascule
      - 4.3.2.6.6.2 Swing
      - 4.3.2.6.6.3 Vertical lift

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INSTRUCTIONS (NOTES)

MODULE: Development of Transportation Systems 3

4.3.2.6.7 Covered
4.3.2.6.8 Pontoon
4.3.2.6.9 Others
4.3.2.7 Mass Transit

4.4 Sea Transportation
4.4.1 Types
4.4.1.1 Sailing vessels
4.4.1.2 Ship building
4.4.2 Development
4.4.2.1 Sailing vessels
4.4.2.1.1 Sailboats
4.4.2.1.1.1 Reed
4.4.2.1.1.2 Wood
4.4.2.1.1.3 Metal
4.4.2.1.1.4 Fiberglass
4.4.2.1.2 Steam boats
4.4.2.1.3 Ocean liners
4.4.2.1.4 Freighters
4.4.2.1.5 Oil tankers
4.4.2.1.6 Submarines
4.4.2.2 Ship building

4.5 Air Transportation
4.5.1 Types
4.5.1.1 Balloons
4.5.1.2 Airplanes
4.5.1.3 Rockets
4.5.1.4 Space Shuttle
4.5.1.5 Space Platform
4.5.2 Development
4.5.2.1 Balloons
4.5.2.2 Airplanes
4.5.2.2.1 Bi-plane
4.5.2.2.2 Single wing
4.5.2.2.3 Jet
4.5.2.3 Rockets
4.5.2.4 Space Shuttle
4.5.2.5 Space Platform

4.6 Specialized Movement of Goods and Materials
4.6.1 Types
4.6.1.1 Aquaducts
4.6.1.2 Conveyors
4.6.1.3 Pipelines

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MODULE: Development of Transportation Systems 4

4.6.2 Development
- 4.6.2.1 Aquaducts
- 4.6.2.2 Conveyors
- 4.6.2.3 Pipelines
  - 4.6.2.3.1 Water
  - 4.6.2.3.2 Oil
  - 4.6.2.3.3 Gas
  - 4.6.2.3.4 Other materials

PERFORMANCE OBJECTIVES/SUPPORTING COMPETENCIES

1. The student will be able to discuss the historical development of Transportation Systems. This will be accomplished by:
   a. Defining the term Transportation Systems.
   b. Identifying and describing the four types of Transportation Systems.
   c. Describing the evolution of Transportation Systems.

2. The student will be able to discuss and demonstrate the historical development of Inland Transportation and its relationship to technological advancements. This will be accomplished by:
   a. Identifying and describing types of Inland Transportation vehicles.
   b. Describing the development of Inland Transportation System devices. For example:
      1) sailing vessels
      2) canals
      3) roads
      4) land vehicles
      5) railroads and equipment
      6) bridges
      7) mass transit
   c. Constructing scale models of Inland Transportation vehicles.
   d. Constructing full size vehicles common to Inland Transportation. For example:
      1) canoe
      2) flat bottom boat
      3) pony cart
   e. Visiting historical sites, museums, historical societies to gather historical information for report on specific Inland Transportation vehicle.
   f. Building and testing a bridge.
   g. Producing a nature trail.
   h. Restoring an antique sailing vessel or land vehicle.
   i. Preparing a collection of pictures of Inland Transportation vehicles.
   j. Preparing a collection of models of Inland Transportation vehicles.

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INSTRUCTIONS (NOTES)

MODULE: Development of Transportation Systems 5

3. The student will be able to discuss and demonstrate the historical development of Sea Transportation and its relationship to technological advancements. This will be accomplished by:
   a. Identifying and describing types of Sea Transportation vehicles.
   b. Describing the development of Sea Transportation Systems.
   c. Constructing scale models of Sea Transportation vehicles.
   d. Constructing ½-hull scale model of Sea Transportation vehicle.
   e. Plotting a course for a mythical journey from Egypt to the western continent to be undertaken by a crew on a reed boat.
   f. Visiting historical sites, museums, historical societies to gather historical information for report on specific Sea Transportation vehicle.
   g. Preparing a collection of pictures of Sea Transportation vehicles.
   h. Preparing a collection of models of Sea Transportation vehicles.

4. The student will be able to discuss and demonstrate the historical development of Air Transportation and its relationship to technological advancements. This will be accomplished by:
   a. Identifying and describing types of Air Transportation vehicles.
   b. Describing the development of Air Transportation Systems.
      1) balloons
      2) airplanes
      3) rockets
      4) space shuttle
      5) space platform
   c. Constructing and flying scale models of Air Transportation vehicles. For example:
      1) balloons
      2) gliders
      3) rockets
      4) airplanes
   d. Constructing a wind tunnel.
   e. Visiting historical sites, museums, historical societies to gather historical information for report on specific Air Transportation vehicle.
   f. Preparing a collection of pictures of Air Transportation vehicles.
   g. Preparing a collection of models of Air Transportation vehicles.

5. The student will be able to discuss and demonstrate the historical development of Specialized Movement of Goods and Materials Transportation System and its relationship to technological advancements. This will be accomplished by:
   a. Identifying and describing types of Specialized Movement of Goods and Materials Transportation System devices.
   b. Describing the development of the Specialized Movement of Goods and Materials Transportation System.
      1) aquaducts
      2) conveyors
      3) pipelines

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INSTRUCTIONS (NOTES)

MODULE: Development of Transportation Systems 6

c. Constructing a scale model of a:
   1) aquaduct
   2) conveyor
   3) pipeline

d. Discussing the use of aquaducts for the movement of water:
   1) by the Romans
   2) by New York City

e. Locating natural gas pipeline serving local community.

f. Comparing the movement of goods in Colonial New York State with the movement of goods in present day New York State.

g. Preparing a collection of pictures of:
   1) aquaducts
   2) conveyors
   3) pipelines

h. Preparing a collection of models of:
   1) aquaducts
   2) conveyors
   3) pipelines

SUGGESTED INSTRUCTIONAL STRATEGIES

This listing of instructional strategies includes ideas as to how the students may achieve the module's performance objectives. They are numbered according to their relationship with the items identified as performance objectives/supporting competencies.

1. a. Instructor will present a lesson defining the term "Transportation System", describing the four types of Transportation Systems, and discussing the evolution of these Transportation Systems.

   b. It is recommended that the instructor make a decision at this point to have all students
      1) complete the study of all four types of Transportation Systems, or
      2) divide into four separate groups, each group being assigned a different Transportation System, or
      3) study only one specific Transportation System, or
      4) study two of the Transportation Systems.

2. Inland Transportation
   a. Using models, readings and films, introduce students to the types of Inland Transportation devices and describe the impact the development of these devices had on the Human Race.

   b. Assign a set of plans to students so that different members of the class are constructing scale models of Inland Transportation vehicles, or use plastic/wooden models purchased from educational supply house or hobby shop.

   c. Select one Inland Transportation vehicle, locate plans and have students construct a full-size version.

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MODULE: Development of Transportation Systems 7

d. Visitation to a museum or historical site for information on the evolution of a specific Inland Transportation vehicle. Students select type of vehicle from listing prepared through class discussion.

e. Using plans obtained from instructor, a number of craft sticks, and any type of fasteners, students will construct a bridge that will support the weight of 3 or more bricks.

f. Discuss with class that the foot path was one of the earliest types of highways used by the Human Race. In some societies the foot path was well planned and hidden from others. The students could do the same by developing a nature trail for all students incorporating techniques that will make the trail accessible to handicapped individuals, especially blind people.

g. Locate with students' help an example of an older type of an Inland Transportation vehicle. Discuss why and how the vehicle should be restored. Using latest restoration techniques restore the vehicle.

h. Students will prepare a listing of Inland Transportation System devices and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and preparing a short description of each example.

i. Students will assist the instructor in preparing a collection of models of Inland Transportation vehicles. These will be displayed in class or hallway display case. (See 2.b above.)

j. Add items to Time Line started in Module 1.

k. Using library resources the students are to prepare a report on the future of Mass Transit in their local area.

3. Sea Transportation

a. Using models, readings and films, introduce students to the types of Sea Transportation vehicles and describe the impact the development of these devices had on the Human Race.

b. Assign a set of plans to students so that different members of the class are constructing scale models of Sea Transportation vehicles or use plastic/wooden models purchased from educational supply house or hobby shop.

c. Divide students into groups and assign each group the plans for a specific ½-hull scale model of a ship.

d. Discuss with class the hazards of a sea journey taken in earlier types of Sea Transportation vehicles and assign the task to plot a course for a voyage to be taken in a reed boat from Egypt to the Virgin Islands.

e. Visitation to a museum or historical site for information on the evolution of a specific Sea Transportation vehicle. Students select type of vehicle from listing prepared through class discussion.

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INSTRUCTIONS (NOTES)

MODULE: Development of Transportation Systems 9

e. Using a map of New York State, locate natural gas pipeline.

f. Using library resources, write a short report on the use of conveyor system by major cement company in the Hudson River-Catskill Mountain region of New York State.

g. Using materials obtained from viewing films, reading selected references and from discussion in class, prepare a short report comparing the movement of goods in Colonial New York State with the movement of goods in present New York State. The instructor may wish to assign other time periods.

h. Students will prepare a listing of Specialized Movement of Goods and Materials Transportation devices and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and preparing a short description of each example.

i. Students will assist the instructor in preparing a collection of models of Specialized Movement of Goods and Materials Transportation devices. These will be displayed in appropriate display cases. (See 5.b. above.)

j. Add items to Time Line started in Module 1.

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INSTRUCTIONS (NOTES)

MODULE: Development of Transportation Systems 8

f. Students will prepare a listing of Sea Transportation System devices and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and preparing a short description of each example.

g. Students will assist the instructor in preparing a collection of models of Sea Transportation vehicles. These will be displayed in class or hallway display case. (See 3.b above.)

h. Add items to Time Line started in Module 1.

4. Air Transportation

a. Using models, readings and films, introduce students to the types of Air Transportation vehicles and describe the impact the development of these devices had on the Human Race.

b. Assign a set of plans to students so that different members of the class are constructing scale models or models purchased from educational supply house or hobby shop.

c. Using wind tunnel constructed by class describe the testing of an Air Transportation vehicle and test the scale model constructed.

d. Visitation to a museum or historical site for information on the evolution of a specific Air Transportation vehicle. Students select type of vehicle from listing prepared through class discussion.

e. Students will prepare a listing of Air Transportation System devices and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and preparing a short description of each example.

f. Students will assist the instructor in preparing a collection of models of Air Transportation vehicles. These will be displayed in class or hallway display case. (See 4.b above.)

g. Add items to Time Line started in Module 1.

5. Specialized Movement of Goods and Materials Transportation

a. Using models, readings and films, introduce students to the types of Specialized Movement of Goods and Materials Transportation System devices and describe the impact the development of these devices had on the Human Race.

b. Assign a set of plans to students so that different members of the class are constructing scale models of Specialized Movement of Goods and Materials Transportation devices.

c. Using library resources, write a short report on the use of aquaducts by the Romans and by New York City for the movement of water to their population center.

d. Using a map of New York State trace the route of the movement of drinking water from throughout New York State to New York City. Prepare a short report describing the evolution of this system.

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PHASE - Development ELEMENT - History of Technology

MODULE NO. 5 Development of Production Systems

TOPICS: Introduction to Production Systems
Agricultural Production Systems
Construction Production Systems
Manufacturing Production Systems

PREREQUISITES: History of Technology
Module 1 - Development of Technology
Module 2 - Development of Resources
Module 3 - Systems

prepared by

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Mr. Chet Ferry, Spencerport BOCES

TOTAL TEACHING TIME - 0-12 Weeks DATE: December 1984

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MODULE: Development of Production Systems 1

OVERVIEW OF MODULE

Goals:

The students will be able to develop and demonstrate an understanding of the historical development of Agricultural Production Systems, Construction Production Systems, and Manufacturing Production Systems.

Description:

Students will be introduced to the historical development of Production Systems. They will have the opportunity to construct devices, prepare collections, and perform activities to increase their awareness of the relationship of the development of Agricultural Production Systems, Construction Production Systems, and Manufacturing Production Systems to the technological advancement of the Human Race.

Skills, knowledge, behaviors to be developed:

The student will be able to:

1. identify types of Production Systems.
2. describe the historical development of:
   a. Agricultural Production Systems
   b. Construction Production Systems
   c. Manufacturing Production Systems
3. discuss and demonstrate the relationship of the development of Agricultural Production Systems with technological advancement.
4. discuss and demonstrate the relationship of the development of Construction Production Systems with technological advancement.
5. discuss and demonstrate the relationship of the development of Manufacturing Production Systems with technological advancement.
6. discuss and demonstrate the relationship of the development of Agricultural Production Systems with the advancement of the Human Race.
7. discuss and demonstrate the relationship of the development of Construction Production Systems with the advancement of the Human Race.
8. discuss and demonstrate the relationship of the development of Manufacturing Production Systems with the advancement of the Human Race.

CONTENT OUTLINE

5.1 Introduction to Production Systems
  5.1.1 Definition of Production Systems
  5.1.2 Types of Production Systems
    5.1.2.1 Agricultural Production Systems
    5.1.2.2 Construction Production Systems
    5.1.2.3 Manufacturing Production Systems

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INSTRUCTIONS (NOTES)

MODULE: Development of Production Systems 2

5.2 Agricultural Production Systems
- 5.2.1 Definition of Agricultural Production Systems
- 5.2.2 Types
  - 5.2.2.1 Farming
  - 5.2.2.2 Food Processing
- 5.2.3 Evolution
  - 5.2.3.1 Farming
  - 5.2.3.2 Food Processing
- 5.2.4 How Used Today
  - 5.2.4.1 Farming
  - 5.2.4.2 Food Processing
- 5.2.5 Future Projections
  - 5.2.5.1 Farming
  - 5.2.5.2 Food Processing

5.3 Construction Production Systems
- 5.3.1 Definition of Construction Production Systems
- 5.3.2 Development of the Construction Production Systems
  - 5.3.2.1 Early Agricultural Society
  - 5.3.2.2 The Pre-Industrial Society
  - 5.3.2.3 The Industrial Society
  - 5.3.2.4 The Post Industrial Society
  - 5.3.2.5 The Information/Service/High Technology Society
- 5.3.3 Types
  - 5.3.3.1 Homes
    - 5.3.3.1.1 examples
      - 5.3.3.1.1.1 farm
      - 5.3.3.1.1.2 non-farm
        - 5.3.3.1.1.2.1 private
        - 5.3.3.1.1.2.2 apartments
          - -low rise
          - - high rise
    - 5.3.3.1.2 Method of Construction
      - 5.3.3.1.2.1 traditional
      - 5.3.3.1.2.2 pre-cut
      - 5.3.3.1.2.3 pre-fabricated
      - 5.3.3.1.2.4 modular
      - 5.3.3.1.2.5 others
    - 5.3.3.1.3 Construction Equipment Needed
    - 5.3.3.1.4 Construction Materials Needed
    - 5.3.3.1.5 Future Projections
  - 5.3.3.2 Commercial Buildings
    - 5.3.3.2.1 Examples
      - 5.3.3.2.1.1 office buildings
        - 5.3.3.2.1.1.1 low rise
        - 5.3.3.2.1.1.2 high rise
      - 5.3.3.2.1.2 factory buildings

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INSTRUCTIONS (NOTES)

MODULE: Development of Production Systems 3

5.3.3.2.2 Method of Construction
5.3.3.2.2.1 traditional
5.3.3.2.2.2 pre-fabricated
5.3.3.2.2.3 modular
5.3.3.2.2.4 others
5.3.3.2.3 Construction Equipment Needed
5.3.3.2.4 Construction Materials Needed
5.3.3.2.5 Future Projections

5.3.3.3 Dams
5.3.3.3.1 Examples
5.3.3.3.1.1 earth
5.3.3.3.1.2 wood
5.3.3.3.1.3 concrete
5.3.3.3.2 Method of Construction
5.3.3.3.2.1 earth
5.3.3.3.2.2 wood
5.3.3.3.2.3 concrete
5.3.3.3.3 Construction Equipment Needed
5.3.3.3.4 Construction Materials Needed
5.3.3.3.5 Future Projections

5.3.3.4 Highways
5.3.3.4.1 Examples
5.3.3.4.1.1 dirt
5.3.3.4.1.2 log/plank
5.3.3.4.1.3 cobblestone/brick
5.3.3.4.1.4 paved
5.3.3.4.1.5 concrete
5.3.3.4.2 Methods of Construction
5.3.3.4.2.1 dirt
5.3.3.4.2.2 log/plank
5.3.3.4.2.3 cobblestone/brick
5.3.3.4.2.4 paved
5.3.3.4.2.5 concrete
5.3.3.4.3 Construction Equipment Needed
5.3.3.4.4 Construction Materials Needed
5.3.3.4.5 Future Projections

5.3.3.5 Bridges
5.3.3.5.1 Examples
5.3.3.5.1.1 beam/girder
5.3.3.5.1.1.1 wood
5.3.3.5.1.1.2 metal
5.3.3.5.1.2 truss
5.3.3.5.1.2.1 wood
5.3.3.5.1.2.2 metal
5.3.3.5.1.3 suspension
5.3.3.5.1.4 cantilever

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INSTRUCTIONS (NOTES)

MODULE: Development of Production Systems — 4

5.3.3.5.1.5 arch
5.3.3.5.1.5.1 stone
5.3.3.5.1.5.2 concrete
5.3.3.5.1.5.3 steel
5.3.3.5.1.6 movable
5.3.3.5.1.6.1 bascule
5.3.3.5.1.6.2 swing
5.3.3.5.1.6.3 vertical lift
5.3.3.5.1.7 covered
5.3.3.5.1.8 pontoon
5.3.3.5.1.9 others
5.3.3.5.2 Method of Construction
5.3.3.5.2.1 wood
5.3.3.5.2.2 concrete
5.3.3.5.2.3 steel
5.3.3.5.3 Construction Equipment Needed
5.3.3.5.4 Construction Materials Needed
5.3.3.5.5 Future Projections

5.4 Manufacturing Production Systems
5.4.1 Evolution of Manufacturing Production Systems
5.4.1.1 Self-reliant individual production
5.4.1.2 Artisan/craftsperson specialization
5.4.1.3 Factories of craftspersons
5.4.1.4 Mass production factories
5.4.1.5 Automated factories-cybernetics
5.4.2 Types of Manufacturing Production Systems
5.4.2.1 Ceramics
5.4.2.1.1 Development
5.4.2.1.2 Raw materials
5.4.2.1.3 Production processes
5.4.2.1.4 Products
5.4.2.1.5 Future Projections
5.4.2.2 Chemicals
5.4.2.2.1 Development
5.4.2.2.2 Raw materials
5.4.2.2.3 Production processes
5.4.2.2.4 Products
5.4.2.2.5 Future Projections
5.4.2.3 Food Processing
5.4.2.3.1 Development
5.4.2.3.2 Raw materials
5.4.2.3.3 Production processes
5.4.2.3.4 Products
5.4.2.3.5 Future Projections

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INSTRUCTIONS (NOTES)

MODULE: Development of Production Systems 5

5.4.2.4 Glass
- 5.4.2.4.1 Development
- 5.4.2.4.2 Raw materials
- 5.4.2.4.3 Production processes
- 5.4.2.4.4 Products
- 5.4.2.4.5 Future Projections

5.4.2.5 Leather
- 5.4.2.5.1 Development
- 5.4.2.5.2 Raw materials
- 5.4.2.5.3 Production processes
- 5.4.2.5.4 Products
- 5.4.2.5.5 Future Projections

5.4.2.6 Metals and Metal Products
- 5.4.2.6.1 Development
- 5.4.2.6.2 Raw materials
- 5.4.2.6.3 Production processes
- 5.4.2.6.4 Products
- 5.4.2.6.5 Future Projections

5.4.2.7 Paper
- 5.4.2.7.1 Development
- 5.4.2.7.2 Raw materials
- 5.4.2.7.3 Production processes
- 5.4.2.7.4 Products
- 5.4.2.7.5 Future Projections

5.4.2.8 Polymers
- 5.4.2.8.1 Development
- 5.4.2.8.2 Raw materials
- 5.4.2.8.3 Production processes
- 5.4.2.8.4 Products
- 5.4.2.8.5 Future Projections

5.4.2.9 Textiles
- 5.4.2.9.1 Development
- 5.4.2.9.2 Raw materials
- 5.4.2.9.3 Production processes
- 5.4.2.9.4 Products
- 5.4.2.9.5 Future Projections

5.4.2.10 Woods
- 5.4.2.10.1 Development
- 5.4.2.10.2 Raw materials
- 5.4.2.10.3 Production processes
- 5.4.2.10.4 Products
- 5.4.2.10.5 Future Projections

5.4.2.11 Others
- 5.4.2.11.1 Development
- 5.4.2.11.2 Raw materials
- 5.4.2.11.3 Production processes
- 5.4.2.11.4 Products
- 5.4.2.11.5 Future Projections

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MODULE: Development of Production Systems 6

PERFORMANCE OBJECTIVES/SUPPORTING COMPETENCIES

1. The student will be able to develop an understanding of the term Production Systems. This will be accomplished by:
   a. Defining the term Production Systems.
   b. Identifying and describing the three types of Production Systems.

2. The student will be able to describe and demonstrate the development of Agricultural Production Systems. This will be accomplished by:
   a. Identifying and describing the two Agricultural Production Systems.
   b. Describing the evolution of the two Agricultural Production Systems.
   c. Describing the impact on society of Agricultural Production Systems.
   d. Describing how the Agricultural Production Systems are used today.
   e. Describing the future of the two Agricultural Production Systems.
   f. Conducting one or more farming activities.
   g. Conducting one or more food processing activities.
   h. Preparing a collection of examples of farming products.
   i. Preparing a collection of pictures of farming processes.
   j. Preparing a collection of pictures of farming equipment.
   k. Preparing a collection of examples of food processing products.
   l. Preparing a collection of pictures of food processing processes.
   m. Preparing a collection of pictures of food processing equipment.

3. The student will be able to describe and demonstrate the development of Construction Production Systems. This will be accomplished by:
   a. Listing the types of Construction Production Systems and identifying at least two examples of each.
   b. Describing the development of the Construction Production Systems.
   c. Describing the impact on society of Construction Production Systems.
   d. Describing the method of construction used by the construction production industry for producing:
      1) homes
      2) commercial buildings
      3) dams
      4) highways
      5) bridges
   e. Describing the future of Construction Production Systems.
   f. Constructing models of:
      1) homes
      2) commercial buildings
      3) dams
      4) highways
      5) bridges

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MODULE: Development of Production Systems 7

g. Producing larger scale examples of home construction such as:
   1) tool shed
   2) greenhouse
   3) play house
h. Producing bridge or path. (As discussed in Module 4.)
i. Preparing a collection of pictures of examples of Construction Production Systems products.
j. Preparing a collection of pictures of examples of Construction Production Systems equipment.

4. The student will be able to describe and demonstrate the development of Manufacturing Production Systems. This will be accomplished by:
   a. Describing the evolution of the Manufacturing Production Systems.
   b. Identifying and describing the different Manufacturing Production Systems.
   c. Describing the development of the different Manufacturing Production Systems.
   d. Identifying the raw materials for each Manufacturing Production System and describing their use. (See Module 2.F. Materials.)
   e. Identifying and describing the processes of each Manufacturing Production System.
   f. Identifying the products of each Manufacturing Production System.
   g. Describing the future of the Manufacturing Production Systems.
   h. Planning for the production of a product utilizing available materials and processes.
   i. Producing a product utilizing available materials and processes.
   j. Preparing a collection of the raw materials used by a Manufacturing Production System.
   k. Preparing a collection of pictures of production processes used by a Manufacturing Production System.
   l. Preparing a collection of products produced by a Manufacturing Production System.

SUGGESTED INSTRUCTIONAL STRATEGIES

This listing of instructional strategies includes ideas as to how the students may achieve the module's performance objectives. They are numbered according to their relationship with the items identified as performance objectives/supporting competencies.

1. a. Instructor will present a lesson defining the term "Production Systems" and describing the three types of Production Systems.
   b. Students will identify the three types of Production Systems by completing an instructor prepared instructional activity sheet.
      1) Write name of each type.
      2) Cite examples of each type that is found in local area.
      3) Identify location of each example on a map of local areas.
      4) List, for each type, products used regularly by the student or the student's family.
      5) Discuss completed activity sheet with class.

MODULE: Development of Production Systems 8

c. It is recommended that the instructor make a decision at this point to have all students:
   1) Complete the study of all three types of Production Systems, or
   2) Divide into three separate groups, each group being assigned a different Production System.

2. Agricultural Production Systems

a. Using models, readings and films, introduce students to the two types of Agricultural Production Systems, describe the evolution of Agricultural Production Systems, describe the impact of the Agricultural Production Systems on the Human Race, describe how the Agricultural Production Systems are used today, and discuss the future of Agricultural Production Systems.

b. Students will prepare a listing of farming processes and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and prepare a short description of each.

c. Students will prepare a listing of farming equipment and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and preparing a short description of each.

d. Students will prepare a listing of food processing processes and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and preparing a short description of each.

e. Students will prepare a listing of food processing equipment and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and preparing a short description of each.

f. Students will assist the instructor in preparing a collection of farming products and display in classroom with a description of each.

g. Students will assist the instructor in preparing a collection of food processing products and display in class with a description of each.

h. Students will assist the instructor in preparing a collection of farming products and display in class with description.

i. Prepare a flow chart illustrating how a farm product evolves from a seed into a useful item. For example: fruits, vegetables, grains.

j. Students will assist the instructor in preparing a collection of food processing products and display in class with description.

k. Prepare a flow chart illustrating how a farm product is changed into a useful product. For example: apples into applesauce, cattle into steaks, etc.

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INSTRUCTIONS (NOTES)

MODULE: Development of Production Systems 9

1. Students working in groups will complete an instructor prepared instructional activity sheet pertaining to the evolution of the two Agricultural Production Systems.
   1) Research topic using selected references.
   2) Visit museum or historical site that contains some aspect of the topic.
   3) Visit a working farm.
   4) Interview a farmer.
   5) Visit a food processing plant.
   6) Interview manager of food processing plant.
   7) Complete activity sheet.
   8) Discuss completed activity sheet with rest of class.

m. Students working in groups will complete an instructor prepared instructional activity sheet pertaining to the impact on society of Agricultural Production Systems.
   1) Research topic using selected references.
   2) Visit museum or historical site that contains some aspect of the topic.
   3) Visit a working farm.
   4) Interview a farmer.
   5) Visit a food processing plant.
   6) Interview manager of food processing plant.
   7) Interview banker.
   8) Interview consumer.
   9) Interview wholesaler.
   10) Interview retailer.
   11) Read publications from U.S. Department of Agriculture, U.S. Department of Commerce, and U.S. Department of Labor.
   12) Read publications from NYS Department of Agriculture and Markets, NYS Department of Commerce and NYS Department of Labor.
   13) Complete activity sheet.
   14) Discuss completed activity sheet with rest of class.

n. Students working in groups will complete an instructor prepared instructional activity sheet pertaining to the future of the two Agricultural Production Systems.
   1) Research topic using selected references.
   2) Visit a working farm.
   3) Interview a farmer.
   4) Interview Cooperative Extension Agent.
   5) Visit a food processing plant.
   6) Interview manager of food processing plant.
   7) Interview banker.
   8) Interview manufacturer and/or distributor of agricultural implements.
   9) Interview consumer.
   10) Interview wholesaler.
   11) Interview retailer.

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INSTRUCTIONS (NOTES)

12) Read publications pertaining to Agricultural activities obtained from the Federal Reserve Banks.
13) Read publications from the U.S. Department of Agriculture, U.S. Department of Commerce, and U.S. Department of Labor.
14) Read publications from the NYS Department of Agriculture and Markets, NYS Department of Commerce and NYS Department of Labor.
15) Complete the activity sheet which should include questions pertaining to:
   a) financing
   b) effect of lesser number of small farms
   c) effect of large industrialized farms
   d) new products
   e) new developments
   f) new equipment
   g) future projections
16) Discuss completed activity sheet with rest of class.

o. Students will assist instructor in preparing a collection of examples (models and toys) of agricultural implements. These examples will be displayed in classroom as part of a diorama of a working farm.

p. If time permits, students might be asked to complete a research report on one or more of the following topics:
1) Financing of agricultural production activities
2) Effect of lesser number of small farms
3) Effect of large industrialized farms
4) New agricultural products
5) New farming equipment
6) New farming processes
7) New food processing processes
8) New food processing equipment

q. Add items to Time Line started in Module 1.

3. Construction Production Systems

a. Using models, readings and films introduce students to the different types of Construction Production Systems, describe the evolution of Construction Production Systems, and describe the impact of Construction Production Systems on the Human Race.

b. Students will prepare a listing of the different types of Construction Production Systems and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and prepare a short description of each.

c. Students, working in groups, will complete an instructor prepared instructional activity sheet pertaining to the evolution of Construction Production Systems.
1) Research topic using selected references.
2) Visit a museum or historical site that contains some aspect of the topic.

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3) Visit construction sites.
4) Interview different types of construction workers. For example: plumbers, carpenters, masons, etc.
5) Interview owners of construction industries.
6) Complete activity sheet.
7) Discuss completed activity sheet with class.

d. Students, working in groups, will complete an instructor prepared instructional activity sheet pertaining to the impact on society of Construction Production Systems.
1) Research topic using selected references.
2) Visit museum or historical site that contains some aspect of the topic.
3) Visit construction sites.
4) Interview different types of construction workers.
5) Interview owners of construction industries.
6) Interview bankers.
7) Read publications pertaining to Construction Program Systems obtained from U.S. Department of Commerce and U.S. Department of Labor.
8) Read publications pertaining to Construction Production Systems obtained from NYS Department of Commerce and NYS Department of Labor.
9) Read publications pertaining to Construction Production Systems obtained from Federal Reserve Banks.

e. Students will assist instructor in preparing a display of architectural drawings used for constructing different types of structures during different time periods and discussing the differences.

f. Students, working in groups, will complete an instructor prepared instructional activity sheet pertaining to the methods of construction used to produce:
1) Homes
2) Commercial buildings
3) Dams
4) Highways
5) Bridges

g. Students, working in groups, will complete an instructor prepared instructional activity sheet pertaining to the type of equipment used to construct:
1) Homes
2) Commercial buildings
3) Dams
4) Highways
5) Bridges

h. Students, working in groups, will complete an instructor prepared instructional activity sheet pertaining to the type of materials used to construct:

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INSTRUCTIONS (NOTES) — ALIGN FIRST CHARACTER UNDER THIS ARROW — 6 LINES INCH

1) Homes
2) Commercial buildings
3) Dams
4) Highways
5) Bridges

i. The format for completing the instructor prepared instructional activity sheet mentioned in "g", "h", and "i" will include:
1) Research of topic using selected references.
2) Visit to construction sites.
3) Interviewing different types of construction workers.
4) Interviewing owners of construction companies.
5) Viewing films.

j. Prepare a collection of old construction tools and equipment and compare with present day construction tools and equipment.

k. Students, working in groups, will complete an instructor prepared instructional activity sheet pertaining to the future of Construction Production Systems:
1) Research topic using selected references.
2) Visit museum or historical site that contains some aspect of the topic.
3) Visit construction sites.
4) Interview construction workers.
5) Interview construction company owners.
6) Interview bankers.
7) Read publication pertaining to Construction Production System obtained from U.S. Department of Commerce and U.S. Department of Labor.
8) Read publications pertaining to Construction Production Systems obtained from NYS Department of Commerce and NYS Department of Labor.
9) Read publications pertaining to Construction Production Systems obtained from Federal Reserve Banks.
10) Read material obtained from Associated General Contractors.
11) Read materials obtained from AFL-CIO Building Trades Council.

l. Obtain and discuss drawings of futuristic Construction Production Systems structures such as:
1) Futuristic buildings
2) Environmentally controlled communities
3) Flexible manufacturing facilities

m. Play the Big Builder Game.

n. Working individually or in small groups, plan and construct a scale model of:
1) House
2) Commercial building
3) Dam
4) Highway
5) Bridge

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MODULE: Development of Production Systems 13

o. The scale models should be built using the following instructional format:
   1) Presentation on how to construct models
   2) Discussion of construction techniques
   3) Assisting student planning for scale model
   4) Assisting student construction of scale model

p. The scale models should be planned and constructed to be part of a planned city. The city is to fit on a 4' x 8' piece of plywood. Techniques used for railroad model building should be incorporated into this activity.

q. Use "Community Development" activity found in the IACP World of Construction publications.

r. Working individually or in small groups, plan and construct a larger scale example of home construction such as:
   1) Tool shed
   2) Greenhouse
   3) Playhouse

s. The larger scale examples of home construction should be built using the following instructional format:
   1) Discussion of construction techniques.
   2) Demonstration of how to perform necessary construction techniques.
   3) Demonstrate material handling.
   4) Provide additional information as needed.
   5) Organize the activity and assign student role responsibilities.

t. The larger scale examples of home construction could be planned and constructed as part of a nature trail or recreation area for school district.

u. Plan and construct, as part of nature trail or recreation area, a foot bridge to span a gulley or small creek.

v. Students will assist the instructor in preparing a collection of pictures depicting Construction Production Systems equipment. The pictures will be displayed in classroom with a short description of each.

w. Students will assist instructor in preparing a collection of examples (models and toys) of Construction Production Systems equipment. These examples will be displayed in classroom as part of a diorama of a construction site.

x. Prepare a flow chart illustrating the steps necessary to construct a:
   1) Home
   2) Commercial building
   3) Dam
   4) Highway
   5) Bridge

y. If time permits, students might be asked to complete a research report on one or more of the following topics.

1) Financing of construction production activities
2) New Construction Production Systems
3) New Construction Production techniques
4) New Construction Production equipment

z. Add items to Time Line started in Module 1.

4. Manufacturing Production Systems

a. Using models, readings and films, introduce students to the different types of Manufacturing Production Systems, describe the evolution of Manufacturing Production Systems, and describe the impact of Manufacturing Production Systems on the Human Race.

b. Student will prepare a listing of the different types of Manufacturing Production Systems and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and prepare a short description of each.

c. It is recommended that the instructor make a decision at this point to have all students:
   1) Complete the study of all types of Manufacturing Production Systems, or
   2) Complete the study of a specific Manufacturing Production System, or
   3) Divide into groups, each group being assigned a specific Manufacturing Production System.

d. Students, working in groups, will complete an instructor prepared instructional activity sheet pertaining to the evolution of a specific Manufacturing Production System:
   1) Research of topic using selected references.
   2) Visit to museum or historical site that contains some aspect of the topic.
   3) Visit to manufacturing plants.
   4) View films.
   5) Complete activity sheet.
   6) Discuss completed activity sheet with class.

e. Students, working in groups, will complete an instructor prepared instructional activity sheet pertaining to the impact on the Human Race of a specific Manufacturing Production System:
   1) Research of topic using selected references.
   2) Visit to museum or historical site that contains some aspect of the topic.
   3) Visit to manufacturing plants.
   4) Interview manufacturing workers.
   5) Interview managers of manufacturing plants.
   6) Read publications pertaining to Manufacturing Production Systems obtained from U.S. Department of Commerce and U.S. Department of Labor.
   7) Read publications pertaining to Manufacturing Production Systems obtained from NYS Department of Commerce and NYS Department of Labor.

MODULE: Development of Production Systems 15

8) Read publications from Federal Reserve Banks.
9) Read publications from Manufacturer's Association.
10) Read publications from AFL-CIO

f. Students, working in groups, will complete the following instructor prepared instructional activity sheets:
1) Listing of examples of the products of each Manufacturing Production System and identification of those found in their homes.
2) Identifying and describing the process of each Manufacturing Production Systems.
3) Identifying and explaining the use of the raw materials needed for each Manufacturing Production Systems.
4) Locating on a map the source of raw materials world-wide, in the United States, in New York State, and in local county, and explaining how the raw materials are transported to a manufacturing facility.

g. Prepare a collection of old manufacturing tools and equipment and compare with present day manufacturing tolls and equipment.

h. Plan for the production of a product from one or more Manufacturing Production Systems that utilizes materials and equipment available in local school district.

i. Produce the product.

j. Prepare a collection of raw materials for one or more specific Manufacturing Production Systems and display in class with examples of final product made using the raw materials.

k. Prepare a collection of products produced by one or more specific Manufacturing Production Systems and display in class.

l. If time permits, students might be asked to complete a research report on one or more of the following topics:
1) Financing of manufacturing production activities
2) New Manufacturing Production Systems
3) New Manufacturing Production techniques
4) New Manufacturing Production equipment

m. Prepare a flow chart illustrating the steps necessary to manufacture a product of a specific Manufacturing Production System beginning with the raw materials and ending with a final product.

n. Add items to Time Line started in Module 1.

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TRUCTIONS NOTES)

PHASE - Development — ELEMENT - History of Technology

MODULE NO. 6 Development of Communication and Information Systems

TOPICS: Introduction to Communication and Information Systems
Early Means of Communication
Present Means of Communication

PREREQUISITES: History of Technology
Module 1 - Development of Technology
Module 2 - Development of Resources
Module 3 - Systems

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TOTAL TEACHING TIME - 0-12 Weeks DATE: December 1984

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INSTRUCTIONS (NOTES)

MODULE: Development of Communication and Information Systems 1

OVERVIEW OF MODULE

Goals:

The student will be able to develop and demonstrate an understanding of the historical development of Communication and Information Systems.

Description:

Students will be introduced to the historical development of Communication and Information Systems. They will have the opportunity to construct devices, prepare collections, and perform activities to increase their awareness of the relationship of the development of Communication and Information Systems to the tedhnological advancement of the Human Race.

Skills, knowledge, behaviors to be developed:

The student will be able to:

1. identify types of Communication and Information Systems.
2. describe the historical development of Communication and Information Systems.
3. discuss and demonstrate the relationship of the development of Communication and Information Systems with technological advance ment.
4. discuss and demonstrate the relationship of the development of Communication and Information Systems with the advancement of the Human Race.
5. construct full size and scale models of Communication and Information Systems.

CONTENT OUTLINE

6.1 Introduction to Communication and Information Systems
- 6.1.1 Definition of Communication and Information Systems
- 6.1.2 Types of Communication and Information Systems
  - 6.1.2.1 Early means of communication
    - 6.1.2.1.1 verbal and visual signal
    - 6.1.2.1.2 writing and the alphabet
    - 6.1.2.1.3 printing
  - 6.1.2.2 Present day means of communication
    - 6.1.2.2.1 printed word
    - 6.1.2.2.2 photography
    - 6.1.2.2.3 electronic communication
    - 6.1.2.2.4 computer based information processing

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INSTRUCTIONS (NOTES) — ALIGN FIRST CHARACTER UNDER THIS ARROW — 6 LINES INCH

MODULE: Development of Communication and Information Systems 2

6.2 Early Means of Communication
- 6.2.1 Verbal and visual signal communication
  - 6.2.1.1 Sounds/gestures signals
  - 6.2.1.2 Oral language
  - 6.2.1.3 Maps and charts
- 6.2.2 Writing and the alphabet
  - 6.2.2.1 Writing
    - 6.2.2.1.1 clay tablets
    - 6.2.2.1.2 papyrus
    - 6.2.2.1.3 animal hide
    - 6.2.2.1.4 paper
  - 6.2.2.2 Alphabet
    - 6.2.2.2.1 Egyptian
    - 6.2.2.2.2 Phoenician
    - 6.2.2.2.3 Roman
    - 6.2.2.2.4 Present language
  - 6.2.2.3 Products
    - 6.2.2.3.1 scrolls
    - 6.2.2.3.2 letters
- 6.2.3 Printing
  - 6.2.3.1 Moveable type
  - 6.2.3.2 Printing presses
  - 6.2.3.3 Printed books

6.3 Present Day Means of Communication
- 6.3.1 Printed word
  - 6.3.1.1 Printed word
    - 6.3.1.1.1 relief printing
    - 6.3.1.1.2 offset printing
    - 6.3.1.1.3 screen printing
  - 6.3.1.2 Process
    - 6.3.1.2.1 relief printing
    - 6.3.1.2.2 offset printing
    - 6.3.1.2.3 screen printing
- 6.3.2 Photography
  - 6.3.2.1 Development
    - 6.3.2.1.1 black and white still
    - 6.3.2.1.2 color still
    - 6.3.2.1.3 black and white motion pictures
    - 6.3.2.1.4 color motion pictures
    - 6.3.2.1.5 micro
      - 6.3.2.1.5.1 microfilm
      - 6.3.2.1.5.2 microfiche
      - 6.3.2.1.5.3 others

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MODULE: Development of Communication and Information Systems 3

6.3.2.2 Process
6.3.2.2.1 black and white still
6.3.2.2.2 color still
6.3.2.2.3 black and white motion pictures
6.3.2.2.4 color motion pictures
6.3.2.2.5 micro
6.3.2.2.5.1 microfilm
6.3.2.2.5.2 microfiche
6.3.2.2.5.3 others

6.3.3 Electronic Communications
6.3.3.1 Development
6.3.3.1.1 telegraph
6.3.3.1.2 telephone
6.3.3.1.3 radio
6.3.3.1.4 television
6.3.3.1.5 alarm systems
6.3.3.1.6 satellite communication
6.3.3.2 Process
6.3.3.2.1 telegraph
6.3.3.2.2 telephone
6.3.3.2.3 radio
6.3.3.2.4 television
6.3.3.2.5 alarm systems
6.3.3.2.6 satellite communication

6.3.4 Computer-based Information Processing
6.3.4.1 Development
6.3.4.1.1 business
6.3.4.1.2 industrial
6.3.4.1.3 personal
6.3.4.2 Applications
6.3.4.2.1 business
6.3.4.2.1.1 electronic banking
6.3.4.2.1.2 product pricing (UPC)
6.3.4.2.1.3 others
6.3.4.2.2 industrial
6.3.4.2.2.1 inventory control
6.3.4.2.2.2 production management
6.3.4.2.2.3 others
6.3.4.2.3 personal
6.3.4.2.3.1 budget
6.3.4.2.3.2 computations
6.3.4.2.3.3 recreation
6.3.4.2.3.4 others

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INSTRUCTIONS NOTES)

MODULE: Development of Communication and Information Systems 4

PERFORMANCE OBJECTIVES/SUPPORTING COMPETENCIES

1. The student will be able to develop an understanding of the term Communication and Information Systems. This will be accomplished by:
   a. Defining the term Communication and Information Systems.
   b. Identifying and describing the major types of Communication and Information Systems used for:
      1) early means of communication
      2) present day means of communication

2. The student will be able to describe and demonstrate the development of early Communication and Information Systems. This will be accomplished by:
   a. Identifying and describing early Communication and Information Systems:
      1) verbal and visual signal
      2) writing
      3) printing
   b. Describing the impact on society of early means of communication.
   c. Developing a communication and information systems. For example:
      1) devise simple alphabet
      2) draw a map of the community
      3) draw a map of school property
      4) draw a map of school building explaining how to get from one place to another place
   d. Recreating early methods of writing. For example: preparing a clay tablet, writing on it and firing in kiln.
   e. Using paper made in class to print an example of a memorandum pad.
   f. Preparing a collection of pictures of early Communication and Information System devices.
   g. Preparing a collection of models of early Communication and Information System devices.

3. The student will be able to describe and demonstrate the development of present day Communication and Information Systems. This will be accomplished by:
   a. Identifying and describing present day Communication and Information Systems.
      1) printed word
      2) photography
      3) electronic communication
      4) computer-based information processing
   b. Describing the impact on society of present day means of communication.
   c. Describing the development of the printed word as a means of communication.
   d. Describing present day methods of printing.

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MODULE: Development of Communication and Information Systems 5

e. Printing a message using:
   1) relief printing
   2) offset printing
   3) screen printing

f. Comparing present day printing techniques with earlier methods of printing.

g. Preparing a collection of examples of items printed using earlier printing techniques.

h. Describing the development of photography as a means of communication.

i. Identifying and describing earlier photography techniques.

j. Identifying and describing present day photography techniques.

k. Planning, taking and processing a black and white still.

l. Planning and taking black and white motion pictures.

m. Planning and taking a color still.

n. Planning and taking a color motion picture.

o. Preparing a collection of examples of earlier photography techniques.

p. Preparing a collection of examples of earlier photographic devices.

q. Describing the development of electronic communication.

r. Describing present day means of electronic communication

s. Developing an electronic communication device:
   1) telegraph
   2) telephone
   3) radio
   4) alarm system

t. Comparing a present day electronic communication device with its earlier version. For example: crystal radio with transistor radio.

u. Describing the development of electronic communication devices. For example: crystal radio to vacuum tube radio to transistor radio.

v. Preparing a collection of examples of earlier communication devices.

w. Describing the development of computer-based information processing.

x. Describing present day applications of computer-based information processing:
   1) business applications
   2) industrial applications
   3) personal applications

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INSTRUCTIONS (NOTES)

MODULE: Development of Communication and Information Systems 6

y. Developing and using simple computer program for classroom microcomputer. For example:
   1) home energy audit
   2) budget
   3) inventory control
   4) recreation
   5) simulation game
   6) cost of operating family automobile
   7) computing cost of laboratory supplies
   8) measurement and calculation

z. Comparing method of using computer program with how it would have been done fifty years ago.

aa. Developing new application for modern communication and information processing system.

SUGGESTED INSTRUCTIONAL STRATEGIES

This listing of instructional strategies includes ideas as to how the students may achieve the module's performance objectives. They are numbered according to their relationship with the items identified as performance objectives/supporting competencies.

1. a. Instructor will present a lesson defining the term "Communication and Information Systems" and describing the major types of Communication and Information Systems.

   b. Students will prepare definition of the term "Communication and Information Systems" as it will be used in class.
      1) Students will individually write a definition of the term "Communication System".
      2) Students will individually write a definition of the term "Information Systems".
      3) Students will compare their definitions with those presented by instructor.

   c. Students will prepare a listing of types of Communication and Information Systems.
      1) Divide class into two groups.
      2) One group will identify early means of communication and develop a listing.
      3) The other group will identify present day means of communication.
      4) After a certain time period, established by instructor, the two groups will rejoin for a class discussion where they will refine the two listings.

2. a. Using models, readings and films, introduce students to early Communication and Information Systems, and describe the impact the development of these systems had on the Human Race.

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b. During instructor's lesson students will prepare a listing of the types of early Communication and Information Systems and will prepare a short description of the impact of each type on the advancement of the Human Race.

c. It is recommended that the instructor make a decision at this point to have all students:
   1) Complete the study of all types of early Communication and Information Systems, or
   2) Divide into three groups, each group being assigned a different type of early Communication and Information System.

d. Students will perform activities where they will identify, describe, and produce examples of verbal and visual signal communication.
   1) Have students use pantomime or charades to inform the class about an upcoming school or class event.
   2) Class discussion about the evolution of verbal and visual signals communication. Include in discussion use of body language, use of fires, drums and flags.
   3) To demonstrate the problems of transmitting a message using spoken word or by having message hand copied each time it passes to a new person have the students play "telephone". A written and a verbal message is passed from student to student until all members of the group have received the message. The verbal message delivered to the last student is compared with the original message. The written message, which must be rewritten each time, is also compared in the same manner as the spoken message.

e. Students will perform activities where they will identify, describe, and produce examples of writing communication.
   1) Read instructional sheet on the types of alphabets.
   2) Using instructional sheet containing a simple cryptogram, decode message.
   3) Working in small groups devise an alphabet to be used to pass on a simple message to the rest of the class.
   4) Working in small groups prepare maps of school building, school property and local community that may be used to tell a new comer to the area how to get from one place to another place.
   5) Use an early method to convey a written message to others. For example: clay tablet, hide, cloth.
   6) Produce paper using process that may have been used in earlier times.

f. Students will perform activities where they will identify, describe, and produce examples of printing communication.
   1) Discuss the impact that the development of a printing technology had on the advancement of the Human Race.
   2) Write a 1 or 2 page report on the history of communication using printing technology.
   3) Design and produce a block cut (soap, linoleum, eraser, wood) which will be printed on the paper produced by the class.

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INSTRUCTIONS (NOTES)

MODULE: Development of Communication and Information Systems 8

4) Students will construct, as a class project, a model of Gutenberg Printing Press (available from Dun-Donnelley Publishing Corporation).

g. Students will visit museum or historical site that includes in its collection some aspect of early Communication and Information Systems.

h. Students will prepare a listing of early Communication and Information Systems devices and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating examples of early Communication and Information Systems devices and prepare a short description of each.

i. Students will assist instructor in preparing a collection of models and examples of early Communication and Information Systems devices and display in class or hall display case.

j. Add information to Time Line started in Module 1.

3. a. Using models, readings and films, introduce students to present day Communication and Information Systems, and describe the impact the development of these systems had on the Human Race.

b. During instructor's lesson students will prepare a listing of the types of present day Communication and Information Systems and will prepare a short description of the impact of each type on the advancement of the Human Race.

c. It is recommended that the instructor make a decision at this point to have all students:

1) Complete the study of all types of present day Communication and Information Systems, or

2) Divide into four groups, each group being assigned a different type of present day Communication and Information System.

d. Students will perform activities where they will identify, describe, and produce examples of printed word communication.

1) Prepare a listing of at least seven means of communication that incorporate the use of the printed word. For example: books, magazines, etc. Discuss this listing in class.

2) Using selected references, identify and describe five present day methods of printing.

3) Compare the five present day methods of printing with 5 earlier methods of printing.

4) Within a set time limit, collect for display on class bulletin board and for discussion by class at least 5 examples of printed materials representative of both old and modern printing techniques.

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MODULE: Development of Communication and Information Systems 9

5) Trace the evolution of printing processes by:
   a) working in pairs to produce for each of the participants his/her name and address, using foundry type and a proof of it on the proof press.
   b) taking their individual good quality proofs of their names and addresses and photograph to produce a lithographic negative.
   c) producing a paper plate to reproduce their name and address on to 50 sheets of stationary. (A spirit duplicator may be used if an offset press is not available.)
   d) developing an idea, sketch a mechanical layout from which a hand cut silk screen stencil is produced. Produce 20 good copies for evaluation. (A photo process silk screen may be used in place of hand cut stencils.)

e. Students will perform activities where they will identify, describe, and produce examples of photography communication.
   1) Discuss as part of instructor's presentation the development of photography as a means of communication.
   2) View film and/or slide presentation on the development of photography.
   3) Write a 1-2 page research paper on the evolution of photographic technology.
   4) Compare photography techniques used different time periods.
   5) Visit an industry involved with photographic technology either as a producer of photographic equipment and/or supplies and as a user of photographic technology such as a book or magazine publisher.
   6) Trace the development of photographic processes by:
      a) using a Tri-Camera Obscura.
      b) taking a black and white photograph with a pin hole camera and printing picture.
      c) using an instamatic camera and following proper step-by-step procedure to take, develop and print a black and white picture.
      d) taking a color photograph with an instamatic camera and with a 35mm SLR camera. If facilities are available develop and print picture. Otherwise send out to commercial developer.
   7) Use movie camera to convey message by:
      a) writing a motion picture script, preparing scenery and characters, rehearsing the scenario.
      b) filming the short story using black and white and color film.
      c) review all of the movies and critique as to how well each conveyed its message.
      d) discuss how the filming could have been done using videotape or cassette. If possible, produce the best short study using video processes.

INSTRUCTIONS (NOTES) — ALIGN FIRST CHARACTER UNDER THIS ARROW — 6 LINES INCH

MODULE: Development of Communication and Information Systems 10

f. Students will perform activities where they will identify, describe, and produce examples of electronic communication.
   1) Discuss as part of instructor's presentation the development of electronic communications.
   2) View film and/or slide presentation on the development of electronic communications.
   3) Write a 1-2 page research paper on the evolution of electronic communications.
   4) Compare electronic communication devices from different time periods.
   5) Visit a producer of electronic communication equipment.
   6) Trace the development of electronic communication devices. For example, trace the development of the radio beginning with a crystal radio.
   7) Bring in for display and discussion examples of old and new communication devices.

g. Students will perform activities where they will identify, describe, and produce examples of computer-based information processing communication.
   1) Discuss as part of instructor's presentation the development of computer-based information processing.
   2) View film and/or slide presentation on the development of computer-based information processing.
   3) Write a 1-2 page research paper on the evolution of computer-based information processing.
   4) Visit a local industry that uses computers to control production methods or view a film dealing with the subject.
   5) Visit a local business that uses computer-based information processing.
   6) Visit a supermarket that uses UPC product pricing and have class discussion on how this process has speeded up food and product purchasing. This activity could also be done by viewing film or by having a guest speaker.
   7) Participate in a discussion on the future application of computers in the work place, in the home and for recreational purposes.
   8) Develop a simple program for a microcomputer by:
      a) dividing into groups, each group taking a specific category assigned by instructor and listing personal applications of computer processing. For example: budget, computations, recreation.
      b) participating in a class discussion which summarizes the results of each group's work.
      c) developing a simple program for a microcomputer involving the category their group researched.
   9) Divide into two groups. Group 1 will research and discuss, "How the Use of Computers has Affected Society's Processing Information". The second group will research and discuss, "Historical Methods of Processing Information Without Computers".

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INSTRUCTIONS (NOTES)

MODULE: Development of Communication and Information Systems 11

h. Students will visit museum or historical site that includes in its collection some aspect of present day Communication and Information Systems.

i. Students will prepare a listing of present day Communication and Information Systems devices and cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating examples of present day Communication and Information Systems devices and prepare a short description of each.

j. Students will assist instructor in preparing a collection of models and examples of present day Communication and Information Systems devices and display in class or hall display case.

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INSTRUCTIONS (NOTES) — ALIGN FIRST CHARACTER UNDER THIS ARROW — 6 LINES INCH

PHASE - Development ELEMENT - History of Technology

MODULE NO. 7 Development of Energy Production Systems

TOPICS: Introduction to Energy Production Systems
Early Means of Energy Production
Present Means of Energy Production

PREREQUISITES: History of Technology Module 3 Systems

prepared by

Mr. Martin D. Collins, Baldwinsville Academy and Central School
Dr. Vincent C. D'Ambrosio, SUNY at Oswego
Mr. Chet Ferry, Spencerport BOCES

TOTAL TEACHING TIME - 9-12 Weeks DATE: December 1984

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INSTRUCTIONS (NOTES)

MODULE: Development of Energy Production Systems 1

OVERVIEW OF MODULE

Goal:

The students will be able to develop and demonstrate an understanding of the historical development of Energy Production Systems.

Description:

Students will be introduced to the historical development of Energy Production Systems. They will have the opportunity to construct devices, prepare collections, and perform activities to increase their awareness of the relationship of the development of Energy Production Systems to the technological advancement of the Human Race.

Skills, knowledge, behaviors to be developed:

The student will be able to:

1. identify types of Energy Production Systems.
2. describe the historical development of Energy Production Systems.
3. discuss and demonstrate the relationship of the development of Energy Production Systems with technological advancement.
4. discuss and demonstrate the relationship of the development of Energy Production Systems with the advancement of the Human Race.
5. construct full size and scale models of Energy Production System devices.

CONTENT OUTLINE

7.1 Introduction to Energy Production Systems
- 7.1.1 Definition of energy
- 7.1.2. Definition of Energy Production Systems

7.2 Early Means of Energy Production
- 7.2.1 Development
- 7.2.2 Types
  - 7.2.2.1 Human
  - 7.2.2.2 Animal
  - 7.2.2.3 Water
  - 7.2.2.4 Wind
  - 7.2.2.5 Steam
  - 7.2.2.6 Electricity
  - 7.2.2.7 Solar
  - 7.2.2.8 Chemical

7.3 Present Means of Energy Production
- 7.3.1 Development

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INSTRUCTIONS (NOTES)

MODULE: Development of Energy Production Systems 2

7.3.2 Types
- 7.3.2.1 Electricity
  - 7.3.2.1.1 Water
  - 7.3.2.1.2 Coal
  - 7.3.2.1.3 Solar
  - 7.3.2.1.4 Nuclear
  - 7.3.2.1.5 Geothermal
- 7.3.2.2 Nuclear
- 7.3.2.3 Steam
- 7.3.2.4 Biomass
- 7.3.2.5 Wind
- 7.3.2.6 Solar
  - 7.3.2.6.1 Passive
  - 7.3.2.6.2 Reactive
  - 7.3.2.6.3 Space Stations
- 7.3.2.7 Geothermal
- 7.3.2.8 Oil
- 7.3.2.9 Gasoline
- 7.3.2.10 Water
  - 7.3.2.10.1 Tidal movement
  - 7.3.2.10.2 River flow
- 7.3.2.11 Chemical

PERFORMANCE OBJECTIVES/SUPPORTING COMPETENCIES

1. The student will be able to develop an understanding of the term Energy Production Systems. This will be accomplished by:
   a. Defining the term energy
   b. Defining Energy Production Systems

2. The student will be able to describe and demonstrate the development of early Energy Production Systems. This will be accomplished by:
   a. Listing and describing types of early Energy Production methods.
   b. Describing the impact on society of the early means of Energy Production.
   c. Creating an Energy Production System using early methodology:
      1) windmill
      2) waterwheel
      3)
      4) Aristotle's steam engine
   d. Preparing a collection of pictures of early Energy Production System devices.
   e. Preparing a collection of models of early Energy Production System devices.

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INSTRUCTIONS (NOTES) — ALIGN FIRST CHARACTER UNDER THIS ARROW — 6 LINES INCH

MODULE: Development of Energy Production Systems 3

3. The student will be able to describe and demonstrate the development of present day Energy Production Systems. This will be accomplished by:
   a. Listing and describing types of present day Energy Production methods.
      1) Electricity
      2) Nuclear
      3) Steam
      4) Biomass
      5) Wind
      6) Solar
      7) Geothermal
      8) Oil
      9) Gasoline
      10) Water
      11) Chemical
   b. Describing the impact on society of present means of Energy Production.
   c. Constructing an apparatus which will use energy to complete a task. For example:
      1) Lamp with a dimmer switch
      2) A calculator
      3) Solar heating device
      4) Solar cooking device
      5) Solar dehydrator
   d. Preparing a collection of pictures of present Energy Production System devices.
   e. Preparing a collection of models of present Energy Production System devices.
   f. Describing future projections and advancements of Energy Production.

SUGGESTED INSTRUCTIONAL STRATEGIES

This listing of instructional strategies includes ideas as to how the students may achieve the module's performance objectives. They are numbered according to their relationship with the items identified as performance objectives/supporting competencies.

1. a. Instructor will present a lesson defining the terms "Energy" and "Energy Production Systems".
   b. Instructor will describe different types of Energy Production Systems and the production of energy.
   c. Students will participate in the discussion of terms "Energy" and "Energy Production Systems" and demonstrate their understanding of the terms as they are used in this module.
   d. Students will list ways that energy is produced in New York State.

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INSTRUCTIONS (NOTES)

MODULE: Development of Energy Production Systems 4

e. Instructor will identify devices that use electricity and students will make list of everything in home that uses electricity or energy.

f. Discuss New York State Power Authority and TVA and their impact on their regional areas.

g. Discuss energy transmission using Grid System.

h. Have students list ways energy is produced in New York State citing at least one location for each method identified.

i. Using map of the world, map of the United States, and map of New York State, have students plot locations of energy producing areas and locations of major energy producing sites.

j. Have students describe verbally or by using a map how New York City obtains its electricity from sources in New York State and outside of New York State.

k. Have students identify the major electricity companies in New York State and describe the evolution of one of these companies.

2. a. Using models, readings and films the instructor will introduce students to the types of early energy production methods and describe the impact the development of these methods had on society.

b. Students will visit museums and historic sites, view films, and read reference material to obtain ideas for constructing an early Energy Production System.

c. Students will prepare a listing of early means of energy production and will cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and preparing a short description of each example.

d. Visitation to a museum or historical site for information on the evolution of early Energy Production methods.

e. Describe the impact of Aristotle's contribution to energy production and its relationship to the advancement of the Human Race.

f. Construct a tool that uses man-power for its energy sources. For example:
1) fret saw
2) wood lathe
3) a lifting device

g. Students will aid the instructor in preparing a collection of models of early Energy Production System devices. These devices will be made from kits obtained from educational supply houses or hobby shops or by using plans obtained from reference books and/or magazines.

h. Add information to Time Line started in Module 1.

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INSTRUCTIONS (NOTES)

MODULE: Development of Energy Production Systems 5

3. a. Using models, readings and films the instructor will introduce students to types of present day Energy Production methods and describe the impact the development of these methods had on society.

b. Students will be assigned an activity to construct an apparatus that uses energy to complete a task.

c. Students will write a short report describing how they may use one of the present day Energy Production methods to supply energy to their device. They will also discuss how the function of the apparatus may have been performed in the past.

d. Students will prepare a listing of present day means of energy production and will cite examples of each. Along with the listing the students will prepare a notebook collection of pictures illustrating the examples and preparing a short description of each example.

e. Visitation to a museum or historical site for information on the evolution of present day Energy Production methods.

f. Visitation to one or more of the following electricity generating plants and discussing in class how the plant operates:
   1) Hydroelectric
   2) Steam generation (non-nuclear)
   3) Nuclear power

g. Students will compare the operation of a factory using water power to run machinery with the operation of a factory using electricity to run machinery.

h. Students will locate sites of water operated grist mills and saw mills in their local area.

i. Students will construct a device to use solar power to cook food, dehydrate food, or make tea.

j. Students will construct a device that uses solar power for non-cooking purposes.

k. Students will construct a simple steam engine and use it to propel a Transportation System's device. (See Module 4.)

l. Identify and describe the use of present day Energy Production methods in Third World Countries.

m. Identify where and describe the types of Early Production methods that are still being used in the world today and discuss why.

n. Students will visit farm using methane collector.

o. Students will aid the instructor in preparing a collection of models of present day Energy Production System devices. These devices will be made from kits obtained from educational supply houses or hobby shops or by using plans obtained from reference books and/or magazines.

p. Add information to Time Line started in Module 1.

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INSTRUCTIONS (NOTES)

MODULE: Development of Energy Production Systems 6

q. Instructor may ask students to bring in news items from newspapers and magazines and to predict future developments and place these on the Time Line. (See Module 8.)

r. Prepare a research report on the future of one of the following Energy Production methods and list possible applications:

1) solar energy
2) geothermal energy
3) nuclear energy

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PHASE - Development ELEMENT - History of Technology

MODULE NO. 8 Impact of the Development of Technology on the Human Race

TOPICS:

Devices and products which had or will have significance in triggering change.

Political, economic and social occurrences which had major significance in triggering technological change and vice-versa.

Effect of technological advancement on changes in family structure.

Effect of technological advancement on existing jobs.

Effect of technological advancement on the creation of new and different jobs.

Effect of shift from nomadic to agricultural to pre-industrial to industrial to post-industrial to information/service/high technology society.

Leisure time/life style implications of technological advancements.

Political, economic and social occurrences which have or may have a major significance in restraining technological advancements.

PREREQUISITES: History of Technology Modules 1 to 7

prepared by

Mr. Martin D. Collins, Baldwinsville Academy and Central School
Dr. Vincent C. D'Ambrosio, SUNY at Oswego
Mr. Chet Ferry, Spencerport BOCES

TOTAL TEACHING TIME - 2 Weeks DATE: December 1984

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MODULE: Impact of the Development of Technology on the Human Race 3

j. Designing a product utilizing industrial by-products or scrap materials. For example:
   1) product from wood scraps
   2) product from aluminum scraps
   3) product from polymer scraps
   4) product from quarry scraps
   5) product from manufacturing by-products

k. Designing a leisure time activity center which will meet the needs of a small community. For example:
   1) playground
   2) water front recreational center
   3) park
   4) environmental/nature center
   5) olympic year-round multi-sport center
   6) multi-sport center (baseball, football, soccer, lacross, tennis, swimming, hand-ball, basketball, track, hockey, fencing, horseback riding, skating)

l. Designing a recycling center to utilize scrap materials generated from within the school district.

SUGGESTED INSTRUCTIONAL STRATEGIES

The strategies identified for this module have been developed so that the students may synthesize, analyze and apply concepts presented in Modules 1 through 7 along with the concepts presented in this module to solve problems affecting the Human Race based on their understanding of the historical development of technology.

It is recommended that this module be taught using the interdisciplinary approach.

1. The instructor will begin the module by incorporating the following in presentations to bring together the concepts introduced and studied in Modules 1 to 7:
   a. Devices and products which had or will have significance in triggering change.
   b. Political, economic and social occurrences which had major significance in triggering change and vice-versa.
   c. Effect of technological advancement on change in family structure.
   d. Effect of technological advancement on existing jobs.
   e. Effect of technological advancement on the creation of new and different jobs.
   f. Effect of shift, over the years, from a nomadic society to an information/service/high technology society.
   g. Implications of technological advancements on leisure time and life style.
   h. Political, economic and social occurrences which had or may have a major significance in restraining technological advancements.

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INSTRUCTIONS (NOTES)

MODULE: Impact of the Development of Technology on the Human Race — 4

2a. Students will participate in one or more of the following activities to help them demonstrate their understanding of the concepts presented in Modules 1 through 7 and the information presented by the instructor for this module:

1) Designing an environment which will provide favorable technological conditions for future generations.
2) Designing a product utilizing industrial by-products or scrap materials.
3) Designing a leisure time activity center which will meet the needs of a small community.
4) Designing a recycling center to utilize scrap materials generated from within the school district.

b. The instructor will design each problem so that the students' solution to the problem(s) will incorporate:

1) Devices and concepts pertaining to:
   a) Transportation Systems
   b) Production Systems
   c) Communication and Information Systems
   d) Energy Production Systems
2) Reaction to:
   a) social, political and economic issues
   b) employment/unemployment concerns
   c) family structure concerns
   d) leisure time activities
   e) life style considerations
   f) protection of the environment
   g) accessibility for the handicapped to the work place, to the home, and to recreational facilities

c. Instructor must decide if students:

1) will be divided into four groups, with each group developing a solution to a different design problem and dividing the tasks among the members of the group, or
2) individually, will develop a solution for all four design problems, or
3) as a class, will develop a solution for only one design problem and divide the tasks among the members of the class.

d. Students will perform research for solution to problem by:

1) reading selected library references
2) viewing selected films
3) viewing selected video presentations
4) hearing quest speaker presentations
5) visiting local industries related to the design problem
6) visiting local recreational facilities
7) visiting museums, historic sites, etc. for historical information

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INSTRUCTIONS (NOTES)

MODULE: Impact of the Development of Technology on the Human Race 5

e. Students should prepare a short presentation on how their solution to the problem(s) would apply to a Third World Country.

f. Add material to Time Line started in Module 1 and identify future projections and place on Time Line. Time Line material should be saved, if appropriate, for review by future classes.

3. Instructor may decide not to use the design problems and may want to place instructional efforts on the development of activities related to the topics listed under number 1. For example:

a. Devices and products which had or will have significance in triggering change.
   1) visitation to museum or historical site to identify and observe devices and occurrences related to technological and social developments.
   2) select an item such as a printed circuit board or an "IC" unit and discuss its evolution and effect on society.

b. Political, economic and social occurrences which had major significance in triggering change and vice-versa.
   1) Read government documents containing population statistics and socio-economic factors statistics. Discuss the affect technology may have had on these statistics.
   2) Write an essay on the causes of the great Depression.
   3) Read and discuss about the differences between recession, depression, inflation and their relationship to technological advancement.

c. Effect of technological advancement on existing jobs.
   1) Review New York State Labor Department and the United States Labor Department publications for information concerning employment figures, employment trends, and wages.
   2) Have personnel manager from a local industry speak to the class concerning need for specific type of workers.
   3) Have a local labor union leader speak to the class.
   4) Have guidance counselor speak to class on worker qualifications.

d. Effect of technological advancement on the creation of new and different jobs.
   1) Review New York State Labor Department and the United States Labor Department publications for statistics relating to this topic.
   2) Have personnel manager from a local industry speak to class about this topic.
   3) Have a local labor union leader speak to the class.
   4) Have guidance counselor speak to the class.

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Teaching the Heritage of Technology: Past, Present, and Future

Donald Maley

The heritage of technology is its dominance in the history of human existence. It has taken the human from a position of complete dependency on the environment to the present, where humankind has demonstrated a capability for transforming the environment to meet its needs. Technology has been the instrument of change and progress as well as disruption and destruction. Created out of the genius of humankind, the evolving technology has become a dominant factor in practically all areas of existence. The arts of music, medicine, communication, construction, production, distribution, transportation, and commerce are tangible evidence or expressions of the human's ability to devise, produce, and use technology.

The heritage of technology is, in a sense, the heritage of human ingenuity translated into works of an ever-increasing sophistication that reaches beyond the comprehension of most individuals. It was the extension of human capability through technology in its earliest form that started the long, evolving process that transformed humans from creatures of fragile existence in a hostile environment to the present form of civilization and environmental accommodation. The long trail of human transformation on this planet has evolved into a higher state of human condition as a result of the advancements in technology that became the instruments of change and challenge.

As Washburn (1962) put it, "It was the success of the simplest tools that started the whole trend of human evolution and led to the civilizations of today" (p. 13).

THE HERITAGE OF TECHNOLOGY

There is no simple answer to the question, What is the heritage of technology? It is the standard of living experienced by the peoples of this earth, whether by the primitive cultures of New Guinea, the cultures of the inner city, or the life of the Kansas farmer.

Technology exists in varying states of development in all societies. It is many times the difference between starvation and opulence, between walking and riding, between the scratch plow and the gang plows of the corn belt.

Spier (1968) defined technology as the means by which humans control or modify their natural environment (p. 131). Thus, one might generalize that the heritage of technology is the accumulated changes that the human has brought about in the natural and human-made environment.

The heritage of technology is not just a matter of looking at the history of the human race for its contributions and evolution. The use that contemporary humankind makes of the technology will certainly define the heritage of technology for those who will live in the 21st century. The same may be said about future generations and their use of technology for they, too, will leave a legacy of technological impacts. Thus, the study of the heritage of technology is, really, related to the heritage from the past, the heritage that the present technology will bestow on the next generation, and the technological heritage that future generations will bestow on those who follow.

The profound importance of the technological heritage phenomenon becomes more apparent upon examining how technology may be used to alter the environment, social institutions, and, perhaps, humanity itself. The control of technology is clearly in the hands of humankind, but control must be based on understanding. Thus, teaching of the heritage of technology—past, present, and future—is imperative if we are to understand how we got here, the nature of the impact of present-day technological decisions on tomorrow, and the relevance of tomorrow's technological decisions on the future of the human race. The key to human prosperity in a technological society is a disciplined responsibility tempered and guided by understanding.

WHY TEACH THE HERITAGE OF TECHNOLOGY?

To teach the heritage of technology is to teach the endowment of past genera-

Donald Maley is professor and chairman, Department of Industrial, Technological, and Occupational Education, University of Maryland, College Park. This invited article is an edited excerpt of a longer manuscript.

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tions from the cave dweller to the astronauts of today. It is to teach that which humankind, in its higher mental processes, has been able to fashion and improve on from the beginning of time.

Following are some education-related reasons for teaching the heritage of technology:

1. It is the study of the principal change agent in most societies.
2. It is the study of how the present generation got to where it is today in all of its physical and material accommodations.
3. It may well be the study of that which will sustain life and contribute to human existence in a world that doubles its population every 37 years.
4. The future depends on the use of technology in the present. Thus, a technologically literate society may help guide the processes by which that future is shaped.
5. A democracy in an era so profoundly affected and influenced by technology depends on a citizenry informed about the nature and significance of technology as a prerequisite for effective decision making.
6. To be illiterate of the heritage of technology in the present and future societies is analogous to walking through a forest without recognizing or understanding any of the plants, trees, flora, or fauna—to say nothing about how one might use these items to sustain life and prosper.
7. It is, in many respects, the study of the means by which the human intellect gets translated into the materialism of books, music, art, engineering wonders, space walks, and television from the outer reaches of space.
8. The study of the heritage of technology can provide the basis on which a continuity to history may be established.
9. It has enormous importance to the maintenance and growth of civilized humankind on an earth with finite resources. The proper use of technology and its further development may actually be the thread by which the fabric of human existence can be held together.

WHAT TO STUDY

There are many things to study about the heritage of technology. One aspect, however, deserves our fullest attention. The most beneficial interests of society should be a central focus in such a deliberation. The heart of this issue is, What should the content of the heritage of technology be for all of the citizens in a free and democratic society? This point centers around the general education requirement for intelligent decision-making in a society governed by the democratic ideal.

Decision-making in the context of a democratic society, and as a function related to the general education component, is integrally tied to a variety of involvements with technology in the course of daily living in a free society so dependent on technology for its existence. Such involvements include

- **the user role,** involving the safe and effective use of materials, tools, machines, household items, and the means of recreation.
- **the consumer role,** as related to the purchasing and decision making related to homes, appliances, cars, entertainment media, furniture, boats, clothing, and food.
- **the producer role,** involving the tools, materials, and machinery of agriculture, manufacture, commerce, and service.
- **the voter or decision-maker role,** involving how to choose between alternatives in community development, energy forms, transportation modes, trash and waste disposal, housing, communications systems, resource development, production processes, and so on.

The options available to contemporary persons in the United States are more abundant and more far reaching than was the case of the earlier civilizations. This increase in options is a direct heritage of an advanced technology in a free society.

It is also important to recognize that beyond the general education study of technology, the engineer, technician, scientist, and historian will certainly deal in greater depth in areas of specialization related to their focus or interests. Some will deal with the principles, theories, and scientific dimensions; others will devote their energies to the production of products, structures, equipment, goods, and services.

The study of technology has taken on many different forms in the various educational institutions. Some studies have included (a) in-depth study of such technological areas as transportation, communications, machines, and tools; (b) taxinomical studies of technological areas; and (c) historical studies of technology.

The confinement of the study of technology to a narrow field or area with a considerable penetration may be a matter of individual choice. Yet, that which is purported to be of value to most individuals in the society must be more of a form of general technology that would enable the individual to deal with it in a non-threatening, literate mode of involvement.

The heritage of technology can be taught with respect to three periods in the continuum: past, present, and future.

1. Past heritage would deal with the present impact of technological developments from a previous period. This

would stress the evolution of technological developments in a variety of areas and their impact on the present.

2. The present heritage would deal with the impact of current, present-day technological developments and their implications on the future. This could be with respect to the quality of life, environment, energy sources, water availability, and other factors whose quality and quantity in the future may depend on present uses of technology.

The shaping of the future began yesterday—1, 2, 500, or thousands of years ago. It is an accomplished fact, one about which present-day society can do little. But, we can do something about current technology and how it is used. In this regard, present-day society can define to a degree the nature of the future in so many ways.

3. The future heritage of technology is not as clear as the past or present. But just as every generation of people has had its heritage, the societies of the future will also leave a legacy for future generations. The relevance of the heritage of technology in the future will be substantially increased and perhaps have greater impact due to the ever-increasing need for technology to provide the essential ingredients for human survival and human well-being.

STUDYING THE HERITAGE OF TECHNOLOGY—PAST

One system or process for studying the past heritage of technology is the anthropological unit approach to the study of technology. This approach for industrial arts deals with the study of the evolution of technology. It focuses on the development of background and understandings related to "how we got to where we are today."

The major unit topics are (a) the development of tools and machines and their contribution to the growth of civilization, (b) the development of power and energy and their contribution to the growth of civilization, and (c) the development of communications and transportation and their contribution to the growth of civilization.

The total class selects one of the above major unit topics for study and discussion. The class then identifies subtopics under the particular major unit topic selected. As an example, some subtopics of a unit on tools and machines would be the loom, lathe, ballista, Persian water wheel, drill, cannon, forge, and so on.

Each student would pursue a separate item with an investigation into its development and related history. The student builds a working or static model of his or her selected subtopic, and writes a report emphasizing historical, scientific, and social contributions of the subtopic.

Seminars are held to provide a communication and unifying experience. Each student discusses and describes the early technological development he or she has studied along with its historical and scientific factors and social contributions. Students may also use pictures, illustrations, or components.

Or, if the class had chosen power and energy, the following early developments could be some subtopics: Newcomen steam engine, battery, sails, windmill, waterwheel, and combustion engine.

Technology studies related to communications and transportation can include such subtopics as semaphores, balloons, sailboats, typewriters, and printing.

The anthropological unit is a popular, exciting experience that is involved in a comprehensive design for learning. Major topics are Tools and Machines, Power and Energy, and Communication and Transportation, and their contribution to the growth of civilization.

The production phase includes models and/or replicas, reports, and displays.

Concepts covered are historical factors, technological innovation, scientific factors, contributions to society, construction and development, and technological linkages.

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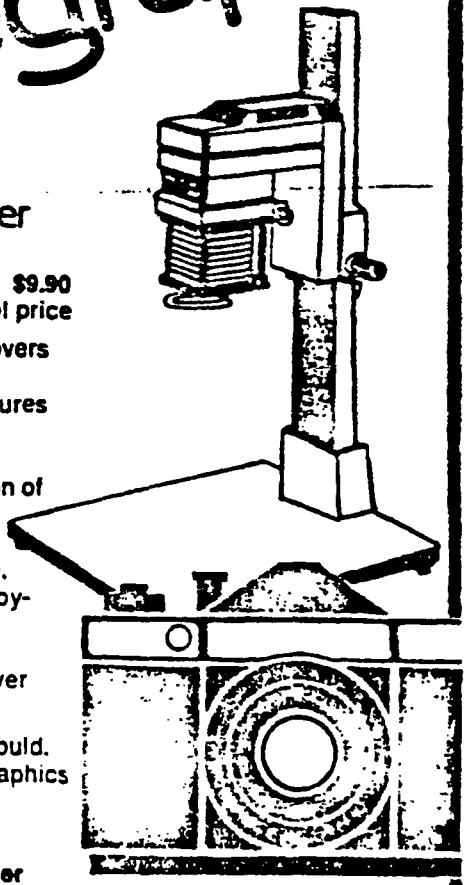

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This evolutionary study of technology has been carried out with considerable success in industrial arts programs in the United States and abroad.

The group project or group process is another excellent form of instructional organization that may be used in the study of past, present, and future technology. This form of instructional organization has several important qualities or characteristics. It

- is a group effort on a single constructional endeavor by the total class or in some cases by subgroups in a given class.
- promotes group planning and coordination and a great deal of internal cooperation.
- provides excellent opportunities for individual students to display their resourcefulness and dependability as well as skills in leadership, followership, intrapersonal relationships, and creativity.
- uses the common personnel organization structure as found in business or industry. This could include a board of directors, project director, public relations director, construction director, purchasing director, design director, and other related roles.
- is an educational experience that reaches into the dimensions of life-like reality in the school setting.
- is an experience that makes effective use of the peer culture relationships that exist at the particular age level.
- has great potential for establishing instructional linkages with the needs of society, the content of the area, the developmental tasks of youth, and the psychology of learning.

Group-project activities include organizing, planning, designing, constructing, creating, investigating, role involvement, problem solving, interpersonal involvement, communications, inquiring, and decision making.

The heritage of past technology may be studied through an endless number of group projects or group processes. A classic example is the development of a model of a 17th-century American village or seaport. Every facet of early colonial life was touched by the heritage of technology whether it be the windlass on the ship, the making of candles, printing of papers and books, building of ships, construction of living or business structures, or the arts of agriculture, weaving, pewtering, wheelwrighting, or blacksmithing.

Other group projects could center around the technology of printing, power generation, systems of transportation, water systems, warfare, and construction. These might deal with the primitive cultures, Romans, Greeks, Egyptians, and Babylonians.

STUDYING THE HERITAGE OF TECHNOLOGY—PRESENT

There are several systems or forms of instructional organizations that would be appropriate in studying present technology from a general technology emphasis or focus. These include research and experimentation, the unit approach, group projects, and community involvement.

The unit process is an important form of such study. Although the study of the past uses the anthropological unit approach, the present involves the contemporary unit approach. Examples of major contemporary unit studies of technology are Communications in Everyday Living, Contemporary Water Development Systems, Contemporary Transportation Systems, Contemporary Energy Development Systems, Contemporary Communications Systems, Contemporary Construction Processes, Contemporary Manufacturing or Production Processes, and so on.

Each of the above would be developed as a unit of instruction, much the same way as the anthropological unit was structured. The only difference is the contemporary nature of the major unit and the subtopics under the major unit.

As an example, Communications in Everyday Living might include the following subtopics for individual students to pursue: radar, printing units, sonar, street signal lights, radio, television, telegraphics, computer graphics, and laser communication, to name a few.

The topics would be dealt with in terms of some form or forms of technological fix.

The community involvement model of educational design for the study of present and future technology has some possibilities that are related to the much-discussed curricular posture of moving the school out into the community and moving the community into the school. The essence of this approach is to identify those problem areas in the community where there is some active pursuit of the problem or to examine problem areas in need but not getting any attention or resolution. Each of these should, of course, lend themselves to technological solution. This is the community problem dimension of the community involvement design for educational experience.

A second community involvement model would use the community as a setting in which the present technology would be studied at the operating site. This could involve visitations, observations, and sessions at such community units as airports and terminals, television stations, transportation centers, city planning centers, water purification centers, construction sites, landfills, museums, fire academies, manufacturing plants, food-processing plants, and energy processing units.

Constructional and design elements of both forms of community involvement instruction would include group and individual projects.

The research and experimentation elements of the study of present technology would take on some highly relevant areas of inquiry. The students could pursue actual research in such areas as home (heat and cold) insulation (consumer/energy), solar-energy use (energy), air-resistance studies (energy), pollution control devices (pollution), water purification (resource development), structural component design (consumer/resources), and process comparisons (production/energy-consumer).

STUDYING THE HERITAGE OF TECHNOLOGY—FUTURE

The study of the heritage of technology—future may be undertaken through a variety of different forms of instructional organization. These could include the unit, group process, community analysis, or individual inquiry instructional procedures.

Because the future is something *to be* experienced and is that which lies ahead at any given time, it might be well to consider what it is about the future that the study of technology—future should be concerned with. The following may provide some direction for the educational design:

1. The individual will be faced with making decisions about technological alternatives to problems and issues.
2. Technology will play an increasing role in the solution of the problems in the future.
3. The design of the future is largely in the hands of humankind.
4. The democratic ideal will require a greater degree of understanding of technology and its potential.
5. The need for adjustment, flexibility, and adaptability on the part of the people.
6. The great emphasis on the ability to learn.
7. There will be a great emphasis on a "sustaining" of resources society rather than on a "depleting" of resources society.

Each of the techniques or instructional procedures listed previously in this section has some role to play in the study of technology with respect to the future.

The study of technological alternatives is very effectively dealt with in the unit approach where a single problem area is identified and each student takes on a different technological approach to the problem. The following is an example:

The unit topic would be, The Development and Application of Alternative Energy Sources in the Solution of Society's Needs in the Future.

Subtopics (selected by individual students) would be solar energy, wind power,

artificial gas from waste, synthetic fuels, geothermal, hydroelectric, chemical, wave (ocean), nuclear fission, nuclear fusion, plant sources, trash utilization, coal, shale, gas, and thermal-differential.

The design of the future is effectively pursued through two different processes previously identified.

a. The group project provides many opportunities for creative experience in developing three-dimensional images of proposed developments with respect to communities or systems in a community.

- *Community (examples)*
  1. Model cities development
  2. Community change models
  3. Inner-city redevelopment
- *System Development (examples)*
  1. Transportations systems
  2. Communications systems
  3. Energy development systems
  4. Housing and recreational systems

b. The community involvement instructional process has an exceptional potential for approaching the design of the future with respect to the kind of a community that would appear appropriate. This would take the realities that exist in a given area or community and then have the classes

1. redesign the community in terms of projected ideals (use of models, drawings, schematics).
2. redevelop certain sections of the given community (use of models, drawings, schematics).
3. redesign the transportation system in a given community (use of models, drawings, schematics, flow charts).
4. develop pollution control measures for a community.
5. develop water and waste treatment facilities in the community.

Each of the above categories of instructional design (unit, group project or community involvement) would have a great deal of individual inquiry and problem solving associated with them. However, if the teacher and the students would elect to pursue such topics on an individual basis, this too could be done. It would be important, however, to provide some systematic procedure for sharing ideas, developments, and outcomes.

SUMMARY

It is important to note that the teaching of the heritage of technology—past, present, and future is much more than dealing with the hardware of technology in given periods. The educational programs should be designed for the development of people capable of living and contributing to the present and the future. This brings into focus the important dimensions of the processes of education.

The impact of the study of technology

human component must deal with the processes of learner involvement in systematic inquiring, problem solving, analyzing, synthesizing, and generalizing. The process of learning to learn and the development of the resourcefulness of the individual must be stressed in any rapidly changing society so profoundly affected by the accelerated technology. The processes of education must also strive for the development of the personal qualities of flexibility, adaptability, and mobility.

These people requirements in the 1980s and the century ahead must grow out of the study of technology. The design for learning will be equally or more important than what is to be learned. The systems previously described—unit studies, group processes, research and experimentation and the community involvement models—are designed around the centrality of the individual in the learning process as well as the human needs to function effectively in the present and future.

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