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AUTHOR Dean, Harvey R., Ed.
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ABSTRACT

Defining industrial communications as the study of methods of originating, developing, and transmitting ideas and information as related to industry and society, the document presents a study of the total system, broken down into the subsystems of originals, reproduction methods, and products. The teacher developed curriculum guide seeks to provide the teacher with the objectives, equipment lists, materi l, supplies, references, and activities necessary to teach students the systems utilized within industries to communicate effectively. Included in the body of knowledge are audio, visual, and other facets of communication technology organized as follows: (1) the original--research, design, preparation, and forms; (2) the reproduction process--project image transfer, direct image transfer, and others; and (3) the product--methods of dissemination, preparation for distribution, storage and retrieval, evaluation, and feedback. A 23-page appendix includes definitions of behavioral objectives, definitions of terms, an attitude inventory, pretest/posttest, equipment/supply unit, and bibliography reference list. The guide is one of the outcomes of the Secondary Exploration of Technology (SET) Project. (MW)

Secondary Exploration of Technology

Cooperative Research - USD 446, 244, & 512 with Kansas State College of Pittsburg & Title III of The State Department of Education, Topeka

Secondary Exploration of Technology

Dear Colleague:

We are happy to forward the Industrial Communications Systems document to you. We feel that implementation of this curriculum will provide relevant education for today's youth.

Implementation of the curriculum as devised will require the equipment listed on page 152. It is further suggested that you review the listed activities and plan to purchase the referenced documents. You will note that many of the referenced pages are included in this document. However, we suggest that you plan to purchase each book for your library or student's use.

We do not contend that the curriculum as presented in this document is the answer. However, the successes that have been realized in the project schools provide justification for its inclusion in industrial education programs.

Prior to implementation of the curriculum, we recommend in-service training of teachers. Most higher educational institutions in Kansas offer an in-service seminar during the summer term. If the S.E.T. Project staff or teachers can be of any help to you in implementation, please do not hesitate to call. Your comments and constructive suggestions are solicited.

Sincerely,

Harvey Dean
Director

blf

S. E. T. PROJECT

Position Paper

on the
Rationale for the Study of the Total Systems of
Materials Analysis and Processing Systems, Power, Industrial Communications Systems
within Industrial Education Classes

The basic idea of the American economic system is to provide services to people or to produce a saleable product for a profit. Industry is that portion of the economic system that provides material goods by changing raw materials into products that have greater value than the raw material. Industrial service industries are concerned with keeping such products usable.

Broad based programs such as IACP Construction and Manufacturing provide students an opportunity to investigate the concepts of the total system of industry through meaningful activities. If one is to further investigate the principles of the total system of industry at or beyond the concept level, it becomes necessary to divide the principles into meaningful sub-systems.

The sub-systems of industry are (A) Governmental Policy (B) Business Management (C) Personnel (D) Material Analysis & Processing Systems (E) Energy Systems (F) Industrial Communications Systems.

The sub-system of Governmental Policy includes the areas of the federal monetary system, natural and/or developed resources, "rules of the game" in which private industry must operate, etc.

Business Management includes the areas of operating our industries. Management topics may be marketing, management, finance, etc.

The sub-system of Personnel includes the "people problems" of industries. Personnel areas may be health, recreation, training, retiring, education, etc.

At this point in time, the Industrial Education Field must assume that the content of the three sub systems described above are taught within other curricular areas in the schools.

The content of the three remaining sub-systems of industry should then be the responsibility of the industrial education curriculum.

The S.E.T. Project systems course in Material Analysis & Processing Systems allows students to experience the methods of processing (changing) raw materials of all kinds into saleable products. It also allows students to experiment with the similarities and differences between raw materials and processing methods.

Power evolved as the need for new material processing methods developed. The developments of power technology are available to everyone in today's society. The developments have raised America's standard of living. The system course in Power provides the student with an understanding of how man has taken the basic forms of energy and systematically converted and transmitted them to work for him. The course also allows students to investigate the function of the prime movers in our transportation systems.

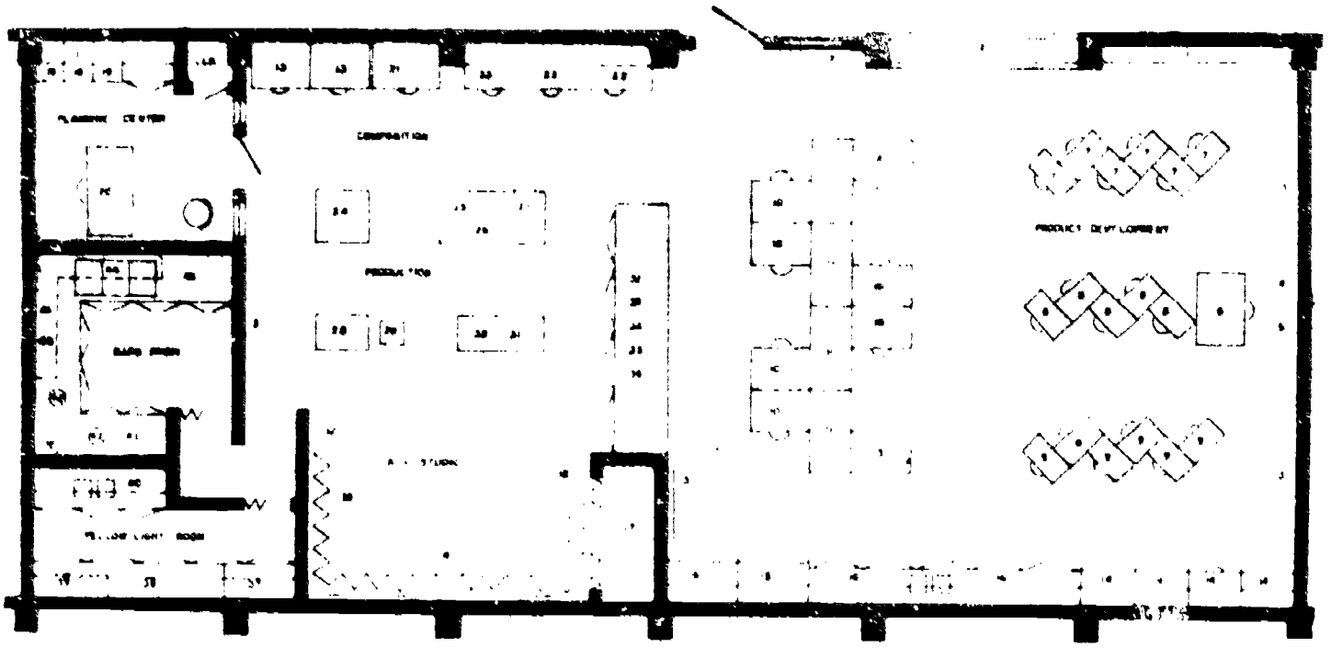
Communication has been, and still is, man's link to man and machine, and machine's link to man and other machines. In industry, communication allows one man's idea to become a reality as a saleable product. The systems course of Industrial Communications provides students with an understanding of how man can develop ideas and communicate them to other people and machines. The course includes various types of communication systems utilized in industrial settings.

Industry is a total system which includes man's changing of materials for man, utilizing the power developed by man, while communicating with all men.

It is impossible to teach the total system of Industry by selecting one element of the sub-system and developing it into a single course. However, after learners conceptualize industry and experience the system, it becomes realistic and psychologically feasible to begin studying the individual elements in individual courses.

S.E.T. Project Teachers and Staff
June, 1973

EXEMPLARY INDUSTRIAL COMMUNICATIONS LAB [illegible] 72 FT.

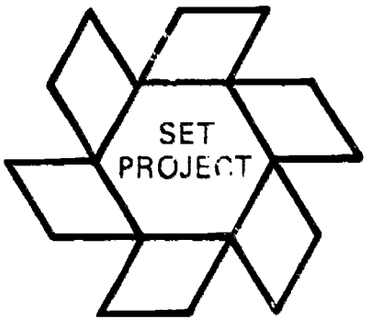


1. bookcase
2. display case
3. bulletin board
4. projection screen
5. chalkboard
6. demo/a-v desk
7. hi-lo drafting table w/t-square
8. hi-lo drafting table w/parallel rule
9. hi-lo drafting table s/arm machine
10. hi-lo drafting table s/belt machine
11. reference table
12. light dimmer controls
13. light table
14. study carrel
15. air brush table
16. modeling and block carving area
17. AV equipment storage
18. curtains
19. files
20. desk
21. copy camera (MP4)
22. selectric typewriter
23. headliner
24. paper cutter
25. rubber stamp press
26. platen press
27. type setting bank
28. offset press
29. jogger
30. folder
31. collator
32. binder
33. saddle sticher
34. paper trimmer
35. paper drill
36. padding press
37. plate maker
38. strip printer
39. diazo
40. ref. under counter
41. print dryer
42. enlarger
43. vertical process camera
44. developing tanks
45. contact printer

INDUSTRIAL COMMUNICATION SYSTEMS

A 9th and/or 10th grade Industrial
Education Curriculum designed to fulfil
the Kansas State Department of Vocational
Education's Level II course requirements.

••••EDITED BY HARVEY DEAN, PROJECT DIRECTOR••••



DEVELOPMENTS OF THE

1972 and 1973 SUMMER WORKSHOPS

ESEA TITLE III PROJECT

26-70-1003

STATE OF KANSAS

INDEPENDENCE – BURLINGTON – SHAWNEE MISSION

IF YOU SHOULD HAVE QUESTIONS, COMMENTS OR REQUESTS
PERTAINING TO THIS CURRICULUM PLEASE CONTACT:

DIRECTOR S.E.T. PROJECT
KANSAS STATE COLLEGE
PITTSBURG, KANSAS 66762

PREFACE

The Secondary Exploration Technology document, **INDUSTRIAL COMMUNICATIONS,** represents a cooperative effort between the Kansas School districts of Independence, Burlington, Shawnee Mission, and KSCP. It further represents a summer of initial trial development by ten (10) S.E.T. teachers with guidance from the S.E.T. Project Staff, a year of trial implementation in the three school districts and a final summer of revision and synthesis by project teachers and staff.

The S.E.T. Project Curriculum seeks to provide the teacher with the objectives, equipment lists, material, supplies, references, and activities necessary to teach students the systems utilized within industries to communicate effectively.

The user of this guide should recognize that activities to encompass the entire body of knowledge as depicted on pages are not included. It is impossible to teach in one semester, one year, or in one program the intracacies of the total body of knowledge. It is possible to teach the concepts of how each communication system interrelates to the total communication system. Therefore, the S.E.T. Project Industrial Communication document provides a guide for the teacher to to teach the Systems of Communication.

The credit for the content in this guide goes to the S.E.T. Teachers who developed, tried, revised and synthesized this curriculum. The curriculum should prove successful in other schools because of the practiced and realistic activities delineated by the teachers.

The Teachers close the equipment as listed in order that Students could successfully complete given activities and meet specified objectives.

Other similar equipment may be available to complete given activities. It is not the purpose of this document to endorse educational equipment but merely to note equipment which proved successful in meeting the listed objectives for specific activities.

ACKNOWLEDGEMENTS

The following men deserve special credit for their work in leading the sessions in which this Curriculum Guide was developed and synthesized:

Chairmen of 1972 Summer Trial Guide development

Jack Thompson
Independence High School
Independence, Kansas

Vernon Pauls
Indian Hills Junior High
Shawnee Mission, Kansas

Coordinator Synthesizing document during
1973 Summer Workshop at KSCP

Vernon Pauls
Indian Hills Junior High
Shawnee Mission, Kansas

Teachers who helped in the development of the Trial Guide, who taught from the trial guide and who helped during the synthesis of the guide:

Charles McCullough
Burlington High School
Burlington, Kansas

Johnie Dombough
Shawnee Mission Northwest High
Shawnee Mission, Kansas

Robert Moore
Shawnee Mission Northwest High
Shawnee Mission, Kansas

Appreciation is also extended to project consultants Mr. Dave Butler, Mr. Morris Tischler, and company representatives who took time to demonstrate equipment to the project developers.

Harvey Dean, Director
F. V. Sullivan, Project Consultant

TABLE OF CONTENTS

COVER SHEET i
PREFACE ii
ACKNOWLEDGEMENTS iii
TABLE OF CONTENTS iv
RATIONALE 1
BODY OF KNOWLEDGE 2
GOALS OF INDUSTRIAL COMMUNICATIONS 3
ACTIVITY OBJECTIVES 4
PERFORMANCE OBJECTIVES 5
COURSE OUTLINE 6
GUIDELINES FOR THE USE OF ACTIVITIES 8
DAILY GUIDE FOR ACTIVITIES
ORIENTATION 9
INTRODUCTION TO COMMUNICATION 10
SYNTHESIS THROUGH PRODUCT DEVELOPMENT 34

APPENDIX
A. Definition of Behavioral Objectives 130
B. Definitions of Terms 134
C. Attitude Inventory 136
D. Pre-Test/Post Test 140
E. Equipment/Supply Unit 151
F. Bibliography Reference List 153

RATIONALE

Since the beginning of time, man has attempted to express his thoughts, wishes and needs to others. He has used various methods to avail the intended receiver of ease in comprehension.

The advent of an industrialized society saw the need for communication by and between people within industries. All phases ofindustry came to require the most advantageous communication systems.

The S.E.T. Industrial Communications document presents a study of the Total System, broken down into the sub-systems of Originals, Reproduction Methods and Products. The Body of Knowledge (see page 2) delinates the content possibilities for an Industrial Communications course. The activities included are in a systematic order and allow students to investigate almost every segment of the Body of Knowledge segments.

Definition of Industrial Communications

Industrial Communications is the study of methods of originating, developing and transmitting ideas and information as related to industry and society.

BODY OF KNOWLEDGE

COMMUNICATIONS TECHNOLOGY

AUDIO | VISUAL | OTHER

ORIGINAL

Research & Design

1. I. D. Problem
2. Define goals
3. Research
4. Limitations
5. Ideation & conception
6. Analysis
7. Experiment
8. Solution description

Preparation of

1. Paste ups
2. Outline
3. Composition
4. Photo retouch
5. Idea sketching
6. Enlarging & reducing
7. Others

Forms of

1. Drawings
   - –sketches
   - –technical
   - –photo
2. Tape
   - –audio
   - –video
3. Printed media
4. Models
5. Stencils
6. Scripts
7. Pos./neg. print
8. Painting
9. Posters
10. Others

REPRODUCING PROCESS

Projected Image Transfer

1. Light
   - –Blueprint
   - –Diazo
   - –Photographic process
     - –enlarging
     - –contact
2. Heat
   - –Thermofax
   - –Others
3. Electro static
   - –Xerox
   - –Others
4. Electromagnetic
   - –Audio tape wire
   - –Video tape
   - –Teletype

Direct Image Transfer

1. Itaglio
2. Planograph
   - –Spirit
   - –Offset
3. Relief
   - –Letter Press
   - –Linoleum Block
   - –Wood Block
   - –Typewriter
4. Stencil
   - –Serography
   - –Mimeograph

Others

PRODUCT

Methods of Dissemination

1. Hard copy
   - –printed copy
   - –eng. prints
   - –photographs
2. Projected
   - –slides
   - –movies
   - –T. V.
   - –holography
3. Electronic
   - –radio
   - –T. V.
   - –teletype
   - –telephone
4. 3-dimensional
   - –models
   - –exhibits

Preparation for Distribution

1. Packaging
2. Assembly
3. Preserving
4. Mounting

Storage & Retrieval

1. Library
2. Microfilm/ microfiche
3. Files
4. Photographs
5. Computer

Evaluation & Feedback

1. Survey
2. Testing
3. Acceptance/ rejection
4. Analysis

GOALS FOR COMMUNICATIONS TECHNOLOGY

1. To develop an awareness of the various methods of industrial communications.
2. To provide an understanding of the materials, tools, and processes of industrial communications.
3. To develop an awareness of the effects of communication on the receiver.
4. To develop an understanding of the interrelationship between communications and other areas of industry.
5. To develop a knowledge of the vocations and avocations in and associated with the area of communications technology.
6. To develop a realization of the role of communications in the conservation of resources.
7. To develop an appreciation for the influence communications technology has on a productive society.

BROAD ACTIVITY OBJECTIVES FOR STUDENTS ENROLLED IN INDUSTRIAL COMMUNICATIONS

1. At the completion of the communications technology course, the student will have participated in activities involving the procedures, processes, tools and materials typical of the industrial communication system, as evidenced by the completion of the prescribed activities.

2. At the completion of the research and design unit the student will have researched and designed a product, as evidenced by the preparation of an original.

3. At the completion of the technical preparation unit, the student will have prepared an original into technical form as evidenced by the teacher's records of the completed activity.

4. At the completion of the advertisement media unit the student will have prepared and presented an advertisement, as evidenced by the teacher's record of the completed activity.

5. At the completion of the unit on service information the student will have prepared and reproduced a servicing information enclosure as evidenced by the teacher's records of the completed activities.

6. At the completion of the unit on preparation for distribution the student will have prepared a product for distribution, as evidenced by the teacher's record of the completed activities.

S.E.T. Project Industrial Communications Curriculum

PERFORMANCE OBJECTIVES

The performance objectives listed below should provide realistic attainment levels for students enrolled in the industrial communications course described in this guide. Each teacher may wish to establish his own performance levels for the course rather than use those indicated below. However, the test instruments included in Appendix D should prove valuable regardless of teacher choice.

Performance levels are not established for the activities delineated in this guide. Each teacher using this guide is encouraged to establish performance levels for his own class per activity and to build in his own evaluation criteria.

Definitions of Performance Objectives in the Psychomotor, Affective, and Cognitive domains are included in Appendix A.

Cognitive Performance Objective

Upon exiting the S.E.T. Project Industrial Communications course, the students will indicate a knowledge of Industrial Communications as evidenced by a significant increase of 20% in mean score between pre- and post-testing on the S.E.T. Project Industrial Communications Curriculum test.

Affective Performance Objective

Upon exiting the S.E.T. Project Industrial Communications course, the students will indicate the value of the study of Industrial Communications as evidenced by a 15% increase in the mean score between the S.E.T. Project pre-attitude inventory and the post-attitude inventory.

Psychomotor Performance Objective

During the Communications Technology course the student will perform psychomotor skills in at least the imitation and/or manipulation level as evidenced by the teachers records of successful completion of at least eight of ten teacher selected activities that suggest these levels of skill development.

CONTENT OUTLINE

FOR INDUSTRIAL COMMUNICATIONS COURSE

Suggested for Level I course

The sequence presented in content outline is imperative

for the success of the Systems/Conceptual Approach.

One Semester (days)	Topic of Area of Instruction
3 days	**I. ORIENTATION** A. Pre-test B. Student Orientation
3 weeks	**II. INTRODUCTION TO COMMUNICATIONS** A. How man Communicates B. Communication systems in industry 1. Television and audio 2. Photography 3. Printing 4. Design and drawing 5. Models
14 weeks	**III. SYNTHESIS OF COMMUNICATIONS THROUGH PRODUCT DEVELOPMENT** A. Research and design 1. State problem 2. Retrieve information 3. Describe and evaluate information 4. Rough sketch of solution 5. Refined sketch of solution 6. Make models 7. Experiment and evaluate design 8. Report to management B. Technical Preparation 1. Make technical drawings 2. Make illustrated drawings 3. Write specifications 4. Reproduction of prints C. Presented Media 1. Live presentation a. Compile information (purpose) b. Outline c. Select necessary A.V. materials d. Present information e. Survey 2. T.V. or radio a. Psychology of commercials b. Compile information (purpose) C. Outline d. Write video and audio script e. Staging f. Producing the commercial

Con't. next page

Industrial Communications Course (con't.)

	3. Printed copy a. Compile information and outline b. Design layout and composition C. Paste-up d. Make plate e. Print copies f. Collate and assemble g. Distribution D. Preparing service information 1. Decide information to be used 2. Decide on form of dissemination 3. Compile information 4. Compose information 5. Decide method of dissemination E. Preparation for distribution 1. Design packaging for product
2 days	**IV. POST-TEST** A. Closing class procedures

NOTE CONCERNING THE

BODY OF KNOWLEDGE/CONTENT FORMAT

It is impossible to delineate an activity or activities for each segment of the Body of Knowledge if teaching at the system/concept level. The Body of Knowledge could easily be taught if each component was allotted a given time with no reference made of the interrelationship of components to the total system.

Therefore, the S.E.T. teachers attempted to delineate system level activities within a format that covers the majority of the components found in the Body of Knowledge.

GUIDELINES FOR USE OF THE ENCLOSED ACTIVITIES

The following pages include suggested activities that provide the student with an awareness of the total system of industrial communications. The activities relate to the cognitive, affective, and psychomotor domains of behavior.

We encourage teachers using this document to expand and revise individual activities to fit their own situation. If activities need to be omitted because of time, omit activities from each set, not an entire set of activities.

Teachers should continually relate individual activities to the total body of knowledge. If this relationship is lost, understanding of the total system is lost.

Teacher: You must prepare for each lesson prior to teaching the lesson. The S.E.T. Project staff recommends that you read this entire document before beginning your course.

SECTION I

ORIENTATION

A. PRE–TEST
B. ORIENTATION

DAY 1 (A) The teacher should give a pre-test to each student the first class period. It will measure his knowledge about communications before he has taken the course. After the post-test has been given a gain score can then be calculated.

DAY 2 (B) The next class period should be spent explaining the grading system, class rules, procedures during severe weather, and any general information concerning safety.

DAY 3 (C) The last day of orientation may be used to assign desks, lockers, show the location of reference material, and the collection of fees.

SECTION II. INTRODUCTION TO COMMUNICATIONS

A. HOW MAN COMMUNICATES

Man communicates ideas and feelings largely through the use of symbols. Symbols may be transmitted either verbally or non-verbally. Examples of each are: spoken and written words, photographs, drawings, and signs. Each is a symbol communicating an idea. To be effective and to be understood the symbols need to be universal in meaning. (Refer to page 15 for an activity to communicate the above information)

B. COMMUNICATION SYSTEMS IN INDUSTRY

Each of the five communication systems listed under Section II (Refer to content outline page 10) are utilized within industry in some degree. They are all dependent upon each other and are interrelated. Each may also be an industry in itself.

It should be understood that the five listed systems are methods that industry uses to communicate. As the students work on the activities in this curriculum a constant relationship should be shown by the teacher to the systems involvement in the total industrial communication system.

(Refer to page 16 for an activity to communicate the above information)

SECTION II. INTRODUCTION TO COMMUNICATION

ACTIVITY
"How Man Communicates"

allow 1 class period

OBJECTIVE: At the conclusion of this activity the student will have a knowledge of verbal and non-verbal communication methods as evidenced by participation in the activity.

EQUIPMENT AND SUPPLIES NEEDED: Flash cards, VTR equipment if available, tape recorder, colored sheets paper

REFERENCE MATERIAL: COMMUNICATING WITH GRAPHICS, A.B. Dick, pages 6, 7, 37, 39, 41, 43, 45 not included
DRAFTING TECHNOLOGY & PRACTICE, Spence, Bennett Publishing Co., pages 12-21, not included
BASIC INDUSTRIAL DRAFTING, Spence, Bennett Publishing Co., pages 8-10, not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. Communications is the transmitting of an idea or feeling to another. It is accomplished through the use of symbols. This is the basis of any communication system.

   B. Key points
      a. Man has an inherent need to communicate.
      b. Man communicates through symbols.
      c. Ideas should be organized and analyzed when communicating.
      d. Non-verbal symbols are usually more effective than verbal when communicating.
      e. The response to a communicated idea is either positive or negative.

2. Teaching Procedure:
   A. Explain that communications is either verbal or non-verbal

   B. Present certain symbols to the students, and ask them to respond either as a group or individually
      1. Playback recorded words from a tape recorder.
      2. Display several colored sheets of paper.
      3. Draw several signs frequently found in industry. Universal road signs, etc.
      4. Use flash cards with either printed words or letters.
      5. Show certain images on aT.V. screen recorded from a VTR.

SECTION II. INTRODUCTION TO COMMUNICATION

ACTIVITY
"Communication Systems in Industry-Television"

Allow 2 class periods

OBJECTIVE: At the conclusion of this activity the student will understand that television is a system used to communicate visual and sound information as evidenced by successful completion of assigned activities.

EQUIPMENT AND SUPPLIES NEEDED: T.V. camera, Video tape recorder (VTR), script format, tripod, monitor set

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. Television systems are utilized in industry. Television is also an industry in itself.

   B. Key Points:
      a. Basic equipment is necessary for a television system. Each component has its own function and operation.
      b. A script is used to organize the program content.
      c. Visual images can be recorded, sent, and received through television.
      d. Television has had a great impact upon society and individuals.
      e. There is a wide variety of job classifications involved in television production.

2. Teacher Demonstration of Activity
   A. Teacher should have the basic video tape equipment set-up and operating. Pan several shots across the class allowing the students to watch themselves in the monitor for a short time only.

   B. Explain the general function of each piece of equipment. Explain how they are properly connected and used.

   C. With the camera operating demonstrate the different camera adjustments and shots.
      1. Close-up——full head shot
      2. Medium shot——from knees to head
      3. Long-shot——entire person on screen
      4. Wide or Group shot

   D. Show students a format for developing a script. Show how the information is organized and written out.

   E. Industry uses television systems to:
      1. Remote monitoring for
         a. security
         b. automated operations in hazardous areas
      2. Public relations and advertising
      3. Computer information display

3. Assign Student Activity
   A. Have the students record a short film from a teacher prepared script. Suggested topics would be:
      1. Operating a spirit duplicator
      2. Mounting the film and focusing an enlarger.
      3. Mounting and drying a print on a dryer.
      4. Silk-screening preparation and use.

SECTION II. INTRODUCTION TO COMMUNICATIONS

ACTIVITY

"Communicating Systems in Industry-Photography"

Allow 2-3 class periods

OBJECTIVE: At the completion of this activity, the student will know how a visual image can be recorded and produced as evidenced by correctly answering teacher prepared questions.

EQUIPMENT AND SUPPLIES NEEDED: 35mm or 2¼" camera, developing tank, overlays, light meter, b/w film, thermometer, timer, changing bag, graduate, chemicals, enlarger, tongs, easel, paper safe, gallon containers, already printed b/w prints

REFERENCE MATERIAL: Time-Life, THE CAMERA, pages 62 included
Time-Life, THE PRINT, pages 57,58,59, 60, 61, 62, 63, 64, not inclu[illegible], 90 included
Use Keuffel and Esser Co. transparencies #14-1, 14-3, 14-4, 14-5, 14-7, 14-8 not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. Purpose of this activity is to teach the students how a camera operates, develop film, enlarge, and print photographic paper.

   B. Key Points:
      a. A camera accepts reflected light, condenses it and exposes a piece of film.
      b. The necessary basic parts of a camera should be explained.
      c. Explain variables which must be controlled when taking a picture.
      d. There are many different film formats. Industry uses many of the larger sizes.
      e. Length of time, temperature of chemicals, and quality of chemicals must all be controlled when developing film.
      f. The density and contrast of a film negative should be explained.
      g. The concept of an enlarger is directly opposite that of a camera.

2. Teacher Demonstration:
   A. Explain the common uses of photography to students.

   B. Show students how a camera is loaded with film and advanced.

   C. Explain how a camera should be operated--use overlays.

   D. Either have a student model or use manufactured products; take a roll of pictures. Try to involve the students as much as possible.

   E. Remove the film from the camera. Use a changing bag and develop the film.

   F. Use either a light table or some type projector to show the students the film images.

   G. Have enlarging equipment set-up on a long table and go through the motions of making a print.

   H. Show and discuss printed materials where photographs have been used.

From: Life Library of Photography, The Camera, by the editors of Time-Life Books, copyright 1970 Time Inc.

THE ANATOMY OF A CAMERA EXPLAINED, page 62

All cameras are basically alike. Each is simply a box with a piece of film in one end and a hole in the other. The hole is there so that light can enter the box, strike the chemically sensitized surface of the film and make a picture. Every camera, from the $10 box Brownie to a sophisticated model costing $1,000, works this way. The differences are in how well and how easily they do the job, but the job is always the same: getting light onto film to form an image.

To do the job properly, certain things are needed; these are shown in the cut-away drawing at right. To begin with, there must be a viewing system, a sighting device that enables the user to aim his camera accurately at his subject. The hole that admits light to the camera—the aperture—must be made adjustable, by a device called a diaphragm, to control the amount of light entering. There must be a lens to collect the light and project an image on the film. There must be a movable screen—the shutter—to keep all light out of the camera until the moment arrives for taking a picture. Then a button is pressed, the shutter opens for an instant, just long enough to admit enough light to make a satisfactory image on the film. There must be a device for moving the exposed film out of the way and replacing it with an unexposed piece. Finally, there should be a focusing mechanism to move the lens back and forth so that it can project sharp images of both near and far objects.

All cameras except the very cheapest have all these features in some form. If that is so, then why are there so many different kinds of cameras? The reason is that cameras are asked to do so many different things, under such a wide variety of conditions, that they have had to become specialized. A bulky studio camera has features that make it ideal for making portraits indoors; but for unposed pictures of children at a picnic it is not as good as a pocket-sized candid camera.

The next few pages constitute a short cram course in cameras, explaining which does what best and why. First, cameras will be divided into four basic types and the advantages and disadvantages of each system described. Following that, each type will be evaluated according to what it does best so that the reader, thinking over the kinds of pictures he wants to take, can decide which type is best for him—and seek out the particular model that suits his won skills and pocketbook.

From: Life Library of Photography. The Print, by the editors of Time-Life Books, copyright 1970 Time Inc.

THE ENLARGER, BASIC TOOL OF THE PRINTMAKER, page 90

The enlarger is actually the key element in modern photography. By blowing up very small negatives into prints large enough to be seen clearly, it permits the use of easily portable cameras and economical small film. And it widens esthetic horizons because it provides many opportunities for control of the picture--part or all of a negative can be used, differing exposures can be given separate portions of the print; it is even possible to later perspectives or create distortions.

The enlarger operates like a slide projector mounted vertically on a column. Light from an enclosed lamp shines through a negative and is then focused by a lens to cast an image of the negative on the printing apper, which is placed at the foot of the enlarger column. Distance between lens and image sets the enlargement size.

The controls on an enlarger are simple. The distance from the lens to the paper is regulated by cranking or sliding the entire enlarger head--the housing containing lamp, negative and lens--up or down on its vertical supporting column. The image is focused, in most enlargers, by turning a knob to raise or lower the lens. The lens has a diaphragm aperture control, like that on a camera lens, to regulate the amount of light reaching the print; unless a great amount of light is needed to make up for a very dark negative, the aperture is usually kept small, thus giving the lens enough depth of focus to offset any manual errors in focusing.

The details of control mechanisms vary from model to model, and can make some enlargers easier to use than other ones. But these distinctions are not so important as differences in the optical systems that distribute light.

If light traveled directly from the lamp through the negative, it would be brightest at the center of the picture and dimmer toward the edges; the final print would be darker in the middle than it should be. To avoid this distortion, some enlargers, known as diffusion type, interpose between lamp and negative a sheet of cloudy glass that spreads light uniformly. This diffusion system causes some loss of light, however: it scatters light rays in many directions and much of the light, consequently, never reaches the enlarger lens. It also gives a gently diffused appearance to the print. Many photographers like this effect, particularly for portraits, but such softening of detail may be objectionable when small negatives must be greatly enlarged.

Most enlargers designed for 35mm and other small film sizes commonly used by amateurs spread light uniformly over the negative with "condenser" lenses (and are called condenser enlargers). Between lamp and negative are two saucer-shaped lenses that concentrate the lamp's light so that it passes straight through the negative. Most of the light reaches the lens, increasing efficiency. The straight-line passage also yields crisp detail, since light rays from different points in the negative do not overlap one another.

Although the enlarger is a simple machine, it is also a vital link in the photographic process: tne best camera in the world will not give good pictures if they are printed by an enlarger that shakes when touched, has a poor lens or tends to skip out of focus. A satisfactory enlarger for 35mm and 2¼ x 2¼ film costs about $60.

SECTION II. INTRODUCTION TO COMMUNICATION *ACTIVITY*

"Communication Systems in Industry-Printing"

Allow 2-3 class periods

OBJECTIVE: At the completion of this activity the student will have an understanding of basic printing processes and how each is involved in industry as evidenced by correct answers to teacher prepared questions.

EQUIPMENT AND SUPPLIES NEEDED: Spirit duplicator, spirit masters, Mimeograph masters, linoleum block, relief proof press, rubber stamp & pad, silk screen kit, offset direct plate, cardboard stencils, spray paint, cold type

REFERENCE MATERIAL: GENERAL PRINTING, pages 1, 2, 3, 92, 93 included
AMERICAN INDUSTRIES, pages 81, 82, 83 included
A.B. Dick, IMAGE TRANSFER, (complete book) not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to demonstrate the advantages and disadvantages of the basic printing methods. Each has an outstanding use in industry.

   B. Key Points:

      a. Printing is one of the oldest methods of communicating.
      b. There are four basic systems or ways of printing.
         1. Relief
         2. Intaglio
         3. Planographic
         4. Stencil
      c. The difference in printing systems is primarly the image carrier.
      d. Certain printing methods lend themselves better to quality and others to quantity production.
      e. Continuous tones must be changed to half-tones for printing

2. Teacher Demonstration:
   A. Explain an image carrier and discuss the different types.

   B. Prepare and demonstrate a relief form. Could be either cold type, rubber stamp, or perhaps a linoleum cut. The image carrier has raised surfaces which transfer the ink.

   C. Intaglio printing could be demonstrated by using a linoleum block, plastic sheet, or a copper plate which has been etched. In this type of printing the image carrier has grooves cut in it which carry and transfer the ink.

   D. In Planographic printing the image carrier is relatively flat. Two ways of doing this would be spirit duplicating and lithography. A spirit master can be made easily. A direct image offset plate can also be easily made. A discussion of how metal plates are made might be helpful here. If an offset press is not available, copies can be printed by hand using a pressure roller.

E. Stencil printing can be quite easily demonstrated. This printing method could be shown by one or more of the following methods.
   1. Silk-screening
   2. Cut cardboard and spray paint
   3. Mimeograph stencil

F. After the printing methods have been demonstrated and explained, products printed the various ways should be shown the students.

G. The magnitude of the printing industry alone should be discussed.

GENERAL PRINTING, pages 1, 2, 3, by Glen Cleeton and Charles Pitkin

MAJOR PRINTING PROCESSES

Three classes of graphic reproduction were identified in the preface: printing, duplicating, and art processes. You will recall that four basic methods of graphic reproduction were described in the introduction: relief, intaglio, planographic, and stencil. These are names of specific processes. These are classified and listed in Table 1, along with the names of specific processes. The major printing processes will be summarized here. These are letterpress, gravure, engraving, offset lithography, and screen process printing.

Letterpress Printing

Letterpress printing applies ink directly to paper from metal type and relief plates. Most type is set by machine on Linotypes, Intertypes, or Monotypes. Some is hand set from cast type or from wood type, particualrly in large sizes. The Ludlow is a machine for casting display lines of type for letterpress. Here matrices for each letter are assembled by hand, cast in the machine, and immediately returned to the storage case. Type for relief plates can also be set photographically. All numbering is done by relief numbering machines.

Plates

Relief plates for letterpress can be either original or duplicated from molds. Relief plates once were hand cut in wood. This is unusual, but printers still speak of plates for a type form as "cuts." Most original plates are photoengravings etched in metal, electronic engravings on plastic, or plastic plates.

These plates may be line or halftone. Line cuts refer to type, pen and ink drawings, and other copy which has no shading. Halftones are made of photographs and shaded drawings. Halftones give the illusion of the various tones of gray even though only black ink is used on white paper. This is done by screening the image into a composite of fine dots which blend together to give the illusion of tones. Process color printing is in natrual colors and requires a halftone for each primary color.

Duplicate plates are usually used in publication work and for long runs. This way identical plates can be put on several presses, or plates can be replaced as they wear down on long runs. The original is protected from wear and damage and can be used too in later revisions. Duplicates are made from a matrix molded from the original form. Common duplicate plates are stereotypes (used mostly be newspapers), electrotypes (common in book and periodical printing), and plastic plates (used where shipping weight is a factor).

Presses

There are three types of presses. Platen presses have both the type from and the paper on flat surfaces, so tremendous force is required to print the entire sheet at one instant. In (flat bed) cylinder presses the paper is on a cylinder which rolls over the form. As only a narrow strip is being printed at any instant, less pressure is required. In rotary presses the plate is also curved into a revolving cylinder so no reversing of direction of the type form is necessary. This allows more speed. Platen presses print about 4000 impressions per hour (iph), cylinder presses about 5000 iph, and rotary presses about 18,000.

Web-fed presses print from rolls rather than sheets. Most rotary presses are web fed. Perfecting presses print both sides of the sheet in one run. Color presses have multiple units, one for each color, each with its own set of plates and inking system. Color printing is also done on single-color presses, one color at a time. Color presses are essentially several presses working together with one feed system. Small platen and cylinder presses may be hand fed, but modern commercial presses are equipped with automatic suction feeders to move sheets through the press. All of these are used in letterpress printing, and will be studied in more detail later.

Characteristics

In printing larger forms by letterpress, much time is used in makeready--adjusting the printing pressure at different points. Type and plates may be different heights, large areas require more pressure, etc. Some of this can be corrected before the job goes to press--called pre-makeready. New makeready systems have also reduced makeready time.

Letterpress printing remains the quickest, easiest, and most economical process for short runs of simple type forms such as stationery, envelopes, and programs. Corrections in standing price lists or respacing are easily done in metal type. It gives a dark print which can be recognized by a heavier ring outlining each letter and by an impression into the sheet. Letterpress books may have photographs grouped into sections and printed on slick paper. Most newspapers, magazines, and books with few illustrations are printed letterpress.

New Developments

Recently there have been several innovations in this oldest and most stable of printing processes, brought about by competition between processes. Promising developments are thin wrap-around plates which are light in weight, economical and have the entire form pre-positioned and made ready on one plate. New photographic platemaking techniques reduce costs of original plates to make them more competitive with duplicated molded plates and those for offset lithography. Thin wrap-around plates in low relief are being printed onto a rubber blanket and then offset onto paper. This is called dry offset (or letterset) to distinguish it from the more common use of offset in lithography. Offsetting allows finer detail on rough papers than direct letterpress, eliminates many makeready problems, and eliminates the water balance problems of lithography.

GENERAL PRINTING, pages 92-93, by Glen Cleeton and Charles Pitkin

How an Illustration Prints

Unlike a print, an illustration printed by letterpress cannot have continuous tones, as the inking rollers deposit a film of ink of approximately the same density over the entire surface of the plate.

Reproduction of a continuous tone photograph by the line cut method would give an effect, with middle tones and highlights printing as either black or white.

Several methods can be used to break up the surface of a line plate so that it will not print as a series of sharply contrasting solid masses of black and white. For example, in the Ben Day Process, screens of various patterns can be applied to line engravings before they are etched, to give the print a special overall "texture" or shading. Examples of illustrations "toned" by this and similar processes can be found in newspaper advertisments.

The most common way of producing gradations in tone, or a range of highlights, middle tones, and deep shadows, is to photograph the original of an illustration through a halftone screen--a clear glass plate, diagonally ruled with black lines which cross at right angles. The intensity of the reflected light passing through the screen determines the size of the dots on the finished plate. Printing plates produced by this method are known as halftone photoengravings.

The 120-line screen is probably the most widely used of the various screens available for halftone work. It has 120 lines per inch on each dimension, thus giving 14,400 dots per square inch on the surface of the printing plate. This is fine enough so that the screen pattern is not readily evident to the naked eye, yet it is not so fine that it cannot be used for printing on such papers as super, and the better grades of machine finish.

133-line, 150-line, and sometimes 175-line screens are used for illustrations requiring finer detail in reproduction. Glossy coated papers (enamels) are needed for use with these fine screens. When printed on rougher papers, many of the fine dots (the 150-line screen has 22,500 dots per square inch) strike in the "valleys" of the paper surface and do not print, thus giving a broken screen reproduction.

Coarse screens are needed to print rough papers, and screens ranging to 50-line are available. A few newspaper plants have successfully printed 85-line screen halftones, but most of the metropolitan dailies use 60-line to 80-line.

There are no solid blacks in a halftone plate, unless the engraver has burnished (rubbed down) the near-solid areas to eliminate the screen. Likewise, there are no areas in the highlights which are without the screen pattern, uniess the dots have been etched out, tooled out, or mechanically "dropped out," by the engraver.

Correct printing of a halftone requires that every dot print with its true value as shown on the engraver's proof. A few satisfactory print can be made from a new halftone with practically no makeready by simply applying pressure. However, a careful makeready is required to do a uniformly good job of halftone printing, and to avoid damaging the plate on a run of any considerable length.

Improper make ready results in numerous troubles. Excessive pressure on highlight dots will cause them to wear and print larger. The highlights then appear "muddy." Wear in the middle tones and shadows causes the plate to become shallow in those areas, with the result that the screen fills up with ink, and detail is lost in the print.

Failure to apply an edge sheet will result in wear to the edges of the plate and will give a "wire edge" print. Also, the punch on the back of the sheet will likely cause offset, by picking up ink from the printed sheet below.

Lack of proper pressure on the middle tones and deep shadows may result in one of the following effects, which will spoil the reproduction: (1) picking of the paper surface; (2) a broken screen; (3) fill-up of the screen and offsetting of the ink, resulting from use of too much ink in an effort to overcome poor makeready; or (4) fill-up due to failure of the ink to lift properly. Continuing to print under such conditions permits some of the ink to remain after each impression and build up until the screen becomes completely filled.

Table I

Processes of the Three Classes of Graphic Reproduction and the Basic Surface Used

Basic Surface	Printing	Duplicating	Art Processes
Relief	Letterpress Type: Foundry, Wood, Monotype, Linotype, Ludlow, Numbering Machines Photoengravings: Line, Halftone; Powderless Dycril Plates, Wrap-Around Plates Stereo types Plastic Plates, Electrotypes Brighttype Conversions Dry Offset, Letterset Flexography Hot Stamping Thermography Die Cutting, Creasing	Typewriting: Standard Proportional Spacing, Varityper, Justowriter Carbon Copies, Multigraph (Relief) Addressograph Credit Cards Rubber Stamps Steel Stamps Etched Circuits Sign Printers Embossograph Signs	Block Prints Wood Rubber Linoleum Plastic Sandpaper Stick Prints Wood Engravings (end grain)
Intaglio	Photogravure Sheet-Fed Rotogravure Engraving Copperplate Steel Embossing	Etched Markings Routed Name Plates Embossed Tape Markers	Etchings Soft Ground Mezzotints Aquatints Intaglio Engravings Dry Points Copper Engravings
Planographic	Photo-Offset Lithography: Zinc-Albumin Plates Aluminum-Diazo Plates Deep-Etch Zinc Plates Photo-Gelatin: Collotype	Offset Duplicating: Direct-Image Plates Photo-Transfer Plates Gelatin: Verifax, Ektalith Diffusion: Gevaert, CopyCat, A.B. Dick Electrostatic Xerox, Spirit Duplicating, Ditto, Azograph Gelatin Duplicating Hektograph	Stone Lithographs Plate Lithographs Crayon Stone Marbling
Stencil: Mechanical	Screen Process: Cut Film Direct Photographic Indirect Photographic Carbon tissue Ektagraph Cut Film Negatives	Stencil Duplicating Pad Type: Mimeograph Silk Screen Type: Rex, Gestetner Mechanical Negatives	Screen Process: Tusche-Glue Stenciling Spatter Painting
Energy	Photo Reproduction Processes: Electrostatic Printing (Onset) Photo Etching Resists Phototypesetting Photo Lettering	Photocopying: Transfer, Direct Thermal Copying Electrostatic Copying Blueprinting, Vandykes Whiteprinting (Diazo) X-ray Photographs	Photographs Photograms

AMERICAN INDUSTRIES; pages 81, 82, 83, by Robinson Gerbracht

WHAT ARE THE GRAPHIC ARTS?

The expressing of ideas by such means as words, drawings, numbers, pictures, graphs, and maps are graphic arts. Writing a letter is a graphic art; so is painting a picture; and so is making a photograph or drawing a plan for a project you are going to build.

The graphic arts industries are the industries that produce newspapers, magazines, books, road maps, catalogs, greeting cards, comic books, and similar things. The term "printing" means making the pictures or printed page, so printing is only one part of the graphic arts industries, though it is of course a very important part..

Closely related to the graphic arts industries are other industries which produce paper, ink, and the other materials, tools, and machines used in the graphic arts.

1. The Past

The books and other printing done in the graphic arts industries are so common today that we seldom stop to realize how important they are to our civilization. Printed words and pictures bring us the news, entertain us, and give us directions for doing things and going places. Perhaps their most important use is in education. Just think how much we learn from books and printing, and how difficult it would be to learn without them.

a. Writing surfaces

We do not know exactly when man first used the graphic arts, but we do know that carvings in stone and on the walls of caves were used thousands of years ago to express ideas. As alphabets were developed, man looked for better writing surfaces than stone. Clay tablets were used, first in China, then in other ancient lands. The papyrus (pronounced "pa-pie'rus") of ancient Egypt was the next important writing surface used. It was made fromthe pith of the papyrus plant which grew in the Nile valley. The fibers were soaked in water, then placed on a flat surface. A second layer was added with the fibers placed at a right angle. The layers were pressed together, dried, and rubbed with shells or stones to make a smooth surface. Later, parchment was made by splitting and scraping the skins of sheep, goats, and cows. Vellu, which was similar, was made from the skins of young animals and had a somewhat smoother surface. Papyrus, parchment, and vellum were all quite scarce and expensive. Paper as we know it today was invented by the Chinese about 100 A.D.

Until the middle of the fifteenth century very little printing was done. There were really only two ways of doing it, and neither was very satisfactory. One way was to copy other printing by hand, letter by letter and word by word. This was the process used by the scribes in the monasteries that you may have heard about. The other way was to carve out letters and pictures on a solid block of wood and then

print from the wooden block. This of course was a very slow process, and it was so very expensive that only the richest people could afford to buy books and other printed materials.

b. Movable type

In 1452 Johann Gutenberg, in Germany, developed a system of making single letters out of wood and later out of metal. The single letters (now called "type") could be arranged to spell words and then taken apart to be used over and over again. This single-letter, movable type was such a great improvement over other methods of printing that books and printing quickly became much more common throughout Europe and the rest of the world. The first large book printed by Gutenberg with movable type was the Bible. The first printing plant in what is now the United States was set up in 1639 in Cambridge, Massachusetts.

2. Basic Printing Processes

There are four common systems of printing used today, and practically all printing falls within one of these systems: (a) relief printing, (b) intaglio (pronounced in-tal'-yo) printing, (c) planographic printing, and (d) stencil printing.

a. Relief printing

In relief printing the printing surface is raised above its background. Ordinary type uses this principle. So does a rubber stamp, and so does a linoleum block. The raised surface is inked, usually with a roller of some kind. Then the paper is pressed against the raised printing surface to make an "impression" on the paper.

b. Intaglio printing

Intaglio printing is the exact opposite of relief printing. The printing is done from grooves and valleys that are lower than their background. First, ink is rolled on the entire surface. Then it is wiped off, but some ink remains in the grooves. When paper is pressed onto the surface, the ink is lifted out of its grooves to make the impression on the paper.

c. Planographic printing

In planographic printing, the printing surface and its background are on the same level (or plane). The printing areas are coated with a greasy ink. Water is rolled over the whole surface, but the part which is to print will not become moistened. Then the ink is rolled onto the printing surface. The ink sticks only to the part that is supposed to print, and so when the paper is pressed down, the proper impression is made.

d. Stencil printing

If you cut a hole in the shape of the letter "T" in a piece of cardboard, you would have a stencil. You could put the cardboard over a piece of paper and spray or brush the cardboard with ink. The cardboard would keep the paper clean except where you had cut the "T" shaped hole. The ink would go through the hole and print the letter "T" on the paper. This is the principle of stencil printing.

SECTION II. INTRODUCTION TO COMMUNICATION

ACTIVITY
"Communication Systems in Industry-Design and Drawing"

Allow 2-3 Class periods

OBJECTIVE: At the completion of this activity the student will have a basic understanding of design and drawing as industry uses it as evidenced by completion of teacher assigned drawings.

EQUIPMENT AND SUPPLIES NEEDED: Overlays

REFERENCE MATERIAL: DRAFTING TECHNOLOGY, pages 3, 4, 5, 237 included
WORLD OF DRAFTING, pages 27, 28, 29, 241 not included
Use Keuffel and Esser transparencies # 3-6, 3-7 included
DRAFTING TECHNOLOGY & PRACTICE, Spence, Bennett Pub. Co., pages 32-47, 283-306, 549-584, 631-663, not included
BASIC INDUSTRIAL DRAFTING, Spence, Bennett Pub. Co., pages 17-24, 113-121, 164-174, not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. Designing and drawing is where industry prepares a visual image of an idea.

   B. Key Points:
      a. Sketching is an easy and quick way to develop ideas in the designing process.
      b. The elements of design are basic components which combine to create the visual impression of an idea.
      c. Free use of imagination to develop many alternate solutions to the design problem is necessary.
      d. The several design solutions are then analysed and a decision is made.
      e. Drawings are then prepared which convey the information concisely and accurately.
      f. Drawings may be divided into two types: Detail and Assembly.
      g. Working drawings are used in all phases of industry.

2. Teacher Demonstration and Activity.

   A. Teacher should explain the value of sketching. How an idea can be developed.

   B. Use either an overhead projector or a blackboard, demonstrate to students the principles of thumbnail or simple line sketching.

   C. The elements of a good design should be shown and explained. When products are developed for consumers they must show good design if they are to be accepted.

   D. The teacher should show the students some industrial drawings and explain their purpose. Examples may be:
      1. Schematic of a power system.
      2. Detail drawing.
      3. Architectural Drawing.
      4. Assemble drawing.
      5. Photo-drawing.

   E. It would be helpful to have several students bring a set of house plans from home to show and discuss.

3. Teacher Assign Student Activity
   A. Handout straight line grid paper to students. Have them develop thumbnail sketches of an idea for solving a simple design problem. The design problem should be teacher directed.

   B. After they complete the thumbnail sketches, an explanation should be given concerning isometric pictorial sketching; showing how a one view drawing can show 2 or 3 sides of an object. Students should understand that this type of sketching is the easiest to understand. The students can either further develop their original idea or sketch objects supplied by the teacher.

DRAFTING TECHNOLOGY, pages 3, 4, 5, 237

Importance of Drafting

At this juncture one might conceivably ask--"just what do all these events have to do with drafting?" Actually there is a very direct relationship between drafting and these events. In every instance it is reasonable to assume that some form of graphical communication was used. Drafting is the graphical language used the world over to represent ideas, design or construction. From the very beginning of recorded history man has been forced to prepare drawings. Without them it is questionable if man could have produced what is still in evidence--the fine old buildings, bridges, aqueducts and other structures some of which are recognized as "wonders of the world."

Drafting is the accepted means of expression used by the scientist, engineer, designer, technician and tradesman. Regardless of their work these people either make sketches or drawings or must be able to read them. Usually an idea starts with a rough sketch, then the sketch is refined and eventually it is made into a finished mechanical drawing.

How Much Drafting Is Needed?

As a student preparing for a particular technical profession, you may wonder just how much drafting you should take during your learning stage. To some extent the answer depends on the profession you plan to enter. Naturally, as a scientist you will need less drafting skill than if you intend to become an engineer. On the other hand if your occupational goal is to be an industrial draftsman or technician, the more drafting knowledge and skill you possess the greater will be your initial success in these areas.

In general, it is safe to assume that all technical people should have a thorough understanding of the following basic areas of drafting:

1. Geometric construction
2. Orthographic projection
e. Dimensioning
4. Freehand sketching
5. Sectional views
6. Auxiliary views
7. Fastening devices
8. Working drawings
9. Pictorial drawings

Drafting and Technology

Since drafting is a key function in any engineering or development process, a drawing is regarded as a means of instruction, not a work of art. Because time is an important factor in any industrial organization, a drawing must be simple, concise, and accurate without all of the embellishments of a beautiful picture. The essential factor is understanding--a drawing must clearly convey its intended purpose. Although the execution of a beautiful drawing cannot be justified in terms of time, neither can a sloppy drawing be condoned. A poorly prepared, incomplete or careless drawing merely increases the time element and results in confusion, error and wasted effort by those who must use it.

It is interesting to note that considerable thought is currently being given to practices that may eventually substantially reduce the time required to prepare drawings. Some industries are experimenting with a variety of devices that actually can make drawings. One such device utilizes an electron beam to produce lines, dimensions, and graphical symbols from information supplied by a computer. Another machine can prepare standard type drawings on vellum, glass, or cloth with drawing instruments.

The present limitation of all such equipment is the tremendous cost involved. In the years ahead there is no doubt that economical means will be found to mechanize the process of making drawings. In spite of what may occur, technical personnel will still need to read and interpret drawings. And as a student, you will still need to learn the basic fundamentals of drawing.

Production Drawings page 237

Production drawings, sometimes referred to as working drawings, are the drawings required for the fabrication of any product. Two types of production drawings usually are involved: detail and assembly. A detail drawing contains all of the essential information needed to construct a unit or part of a product. An assembly drawing shows how the various parts of the product are put together.

THE WORLD OF DRAFTING, Ross, page 241

Summary

You have studied the conventional practices and drawing techniques for making pictorial drawings. Isometric drawings are used frequently as a pictorial representation of an object. Isometric drawing is an easy method of drawing and has the appearance of a three-dimensional view.

Note Sheet

ELEMENTS OF DESIGN

The elements of design are basic components which combine to create the total effect desired for a visual impression of an idea.

Line as an element is used in order to achieve results with other elements. Line alone has little meaning. It is possible to have variations of line for specific effects. It may be bold or delicate, curved, angular, or straight, black or colored, even or uneven, or it may represent free flowing linear movements through a combination of any of the above factors.

Shape is a means of defining an area or surface by providing dimension and visual realism. When lines are turned into shapes, they have realistic meanings.

Texture may appear to be rough or smooth, hard or soft, and is a means of giving detail to structures depicted. It generally has the effect of conveying a sense of touch to the viewer. Texture may be developed through the use of line, or it may be achieved through actual textural material of a three-dimensional nature. When three-dimensional materials are applied to graphics, such materials must be lightweight and in keeping with the general context of the message.

Value is the lightness or darkness of an object in terms of the visible light reflected. It will range from absolute light to absolute dark and may be applied to any color which is used in the material. Value is often used as a means of adding dimension to an object.

Color is used for emphasis and definition. Bright colors convey the impression of gaiety while subdued ones convey quietness. Specific effects may be achieved through color with the application of value. It is best to use varying amounts of color in dominating roles to achieve a desired effect. It should be used as an important factor in depicting

an idea, but it should not be used for the sake of color alone.

Volume represents the mass which occupies the space which is encompassed. It represents the totality of a visual impression and implies both solids and voids in terms of space utilization.

The combination of all of the elements applied to the fundamentals of design will present an esthetic and informative visual impression. If the elements are thrown together at random and appear to have no organization, they produce chaos. A basic understanding of elements and fundamentals of design will give teachers and students tools with which to work in order to create effective graphic materials. It is only through an understanding of the tools with which one has to work that a higher level of accomplishment in graphic production can be achieved.

SECTION II. INTRODUCTION TO COMMUNICATIONS

ACTIVITY
"Communication Systems in Industry-Models"

Allow 2 class periods

OBJECTIVE: At the completion of this activity the student will know the types of models and industries and will understand why models are used in industry as evidenced by completion of assigned activity.

EQUIPMENT AND SUPPLIES NEEDED: Hot wire cutter, styrofoam

REFERENCE MATERIAL: WORLD OF MANUFACTURING, pages 73, 74 included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. Models are used in many phases of industry. Designers use them to show a design solution in three-dimensions. Engineers use working models for testing to see that all the components work correctly.

   B. Key Points:
      a. A design solution is easily explained when a model is used.
      b. After rough sketching the designer is usually ready to begin a mock-up.
      c. Models are often used for presenting a design to management.
      d. A proto-type is a full-scale working model of a new product.
      e. Alternate design solutions can be easily developed through the use of models.

2. Teacher Demonstration of Activity
   A.. Teacher should explain the importance of three-dimensional models in industry.

   B. Show students examples of an appearance and hard mock-up.

   C. Explain the type of materials used in industry for making mock-ups.

   D. Explain to the students how prototypes are constructed. Explain their purpose in the development of new products.

3. Assign Student Activity
   A. Have students construct an appearance mock-up from a pictorial sketch supplied by the teacher. Students can either use styrafoam or lightweight cardboard in making their mock-up.

WORLD OF MANUFACTURING, pages 73, 74

MAKING THREE-DIMENSIONAL MODELS

As you have seen from the last reading, three-dimensional models are an important part of the product designing process. *Models are the most important way to explain the design solution. A model is anything of a certain form, shape, size, quality, or construction that is made to be imitated (copied).* A number of terms refer to a model, but mock-up is preferred since "model" often refers to a finished product. For example, "Which model of automobile do you want to buy?" We will look briefly at the different kinds of mock-ups used.

Kinds of Models or Mock-Ups

After the rough sketching, the product designer is usually ready to make a mock-up study. This first rough mock-up is called a paste-up. Paper, glue, cardboard, wood, tape, clay, or any material that will easily show the design solution is used. The main purpose of the paste-up is to give the product designer an idea of how the design will fit its surroundings and how people will use it. The paste-up must be made quickly and cheaply.

A clay model is used when shape is important to the design. It is easy to work with and can easily be changed. Clay models can look like paste-ups; but if special clays are used, they can also be made into very good-looking finished mock-ups.

A scale model is another kind of mock-up. It usually (but not always) refers to a mock-up that is smaller than the final product. Examples are scale models of automobiles and airplanes.

An appearance mock-up follows the paste-up. It can be made of any material and is usually full scale (the same size as the product). It is more completely and carefully done than the paste-up, but it is still a nonworking mock-up. The handles, knobs, and doors do not work. Materials and finishes are pictured as correctly as possible.

A hard mock-up is usually the final mock-up. It is well-made, and important parts such as drawers, knobs, lights, doors, and wheels will work. Materials and finishes should be the same ones that will be used in actual production. It does not include the power units or the basic working parts, such as the cooling system in a refrigerator or the engine in an automobile.

Working Models or Prototypes

Models in which all parts work and which also include all details of appearance are called working models or prototypes. Prototypes of some kinds of products are easier to make than others. For example, the prototype for a pair of pliers or a piece of furniture can be made more easily than the prototype for an airplane or a locomotive engine. Reading 18 covers the prototype in greater detail.

SECTION III

SYNTHESIS OF INDUSTRIAL COMMUNICATION THROUGH PRODUCT DEVELOPMENT

A. Research and Design
B. Technical Preparation
C. Presented Media
D. Preparing Service Information
E. Preparation for Distribution

NOTE: Section III of Industrial Communication is designed to allow the students to experience a total system involving many kinds of communication methods--all typical of methods employed by industry during product development. The teacher should read all of this section before beginning instruction.

After reading Section III and before beginning instruction the teacher should carefully consider the following suggestions:

Suggested products that would work well for teaching the system of product development (Synthesis)

Pencil holder
Charcoal tongs
Candle holder
Space tool
Note holder
Fishing rod holder
Beverage holder for lawn

Suggestions for limitations on design problems:

Size
Cost
Number of parts for assembly
Availability of materials
Kinds of materials
Production difficulty
Application of standard parts
Weight
Type of packaging used
Safety features

SECTION III. SYNTHESIS THROUGH PRODUCTION DEVELOPMENT

A. RESEARCH & DESIGN

ACTIVITY

1. "State the Design Problem"

Allow 1 class period

OBJECTIVE: At the completion of this activity the student will have stated his design problem and listed limitations as evidenced by the completed document.

EQUIPMENT AND SUPPLIES NEEDED: Paper and pencil

REFERENCE MATERIAL: ENGINEERING DESIGN GRAPHICS, Earle, pages 55-56, included
57-69 not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. Purpose of this activity is to show that identifying the problem is a design process.

   B. Teacher: Identify the problem (Refer to enclosed reference.)

      State problem
         Concise
         Comprehensive
         Function of problem
      Problem requirements
         List positive requirements
         List specific requirements
         List general requirements or features
      Problem limitations
         List negative factors that confine problem material limitations
      Physical limitations
         Form
         Size
      List all other data concerning problem

2. Student Activity:
   A. State design problem and list requirements

   B. List limitations, causes, needs, economic background, effects and data.

   C. Possible problems to consider:

ENGINEERING DESIGN GRAPHICS, Earle, pages 55-56

3-1 General and 3-2 Design Work Sheets

3-1 General

The initial step in any designer's approach to the solution of a design problem begins with problem identification. Problem identification can be one of two general types: (1) identification of a need, or (2) identification of design criteria. Identification of a need is a common beginning point for a design project. A problem, defect, or shortcoming is recognized in an existing product, system, or environment. The need may be for an improved automobile safety belt, for a solution to air pollution, for a special hunting apparatus, or for a self-opening can. Identification of a need at this stage is not sufficiently thorough to establish the criteria that must be met in solving the problem; the designer merely recognizes the existence of a need for which a design solution is necessary.

The identification of a problem need is the basis for beginning a design problem. This information can be used to state the problem in a proposal, whether in paragraph form or as a several-page report for formal summission. A proposal is a written plan of action that will be taken to solve a problem that has been identified. Formal proposals are written in much the same form as technical reports, which are covered in Chapter 16. Chapter 20 relates the proposal to the design process as applied to a comprehensive problem. In general, a proposal is a statement of action that would serve as a contractual agreement with an administrator, or with your teacher in a classroom situation.

Once approval has been received to proceed with a proposal, the problem is more thoroughly identified to determine the design criteria. This phase may be performed by a team or by an individual designer. Identification of all aspects of a problem and the various related factors that must be considered in its solution is necessary before effort can be scheduled to bring about a completed design within a specified time. It is this type of identification that the remainder of the chapter will develop. Periodic reference should be made to Chapter 20, where the relationship of problem identification with the total design process is applied to comprehensive problems.

3-2 Design Work Sheets

Throughout the design process, the designer should make numerous notes and sketches to provide a permanent record of his thinking that will serve as a reference. Periodically, he should review his earlier thoughts and notes to avoid overlooking an important concept. His ideas and thoughts are a vital resource--creativity--that should not be discarded after the solution of an immediate problem. Very often, preliminary design studies are not developed to a final stage for a considerable time after the initial work. Also, rough design sketches can serve as a permanent record to establish priority on a patentable design that may be developed. The following materials and format are suggested to enable the designer to effectively accumulate a record of his thoughts. This method will be used in each and every step of the design process.

Materials. It is beneficial to approach the entire design process in an orderly, organized manner. Orderly work will assist the designer in achieving an orderly sequence of ideas.

1. 8½ x 11-inch sketchpad. A sketchpad can be either grid-ruled or plain, depending upon the preference of the designer. Sheets should be punched for insertion in a notebook or file that will contain the accumulation of notes and drawings.

2. Pencils. A medium-grade pencil, such as an F pencil, is adequate when used with most papers. A colored pencil can be used beneficially to emphasize special features or ideas.

3. Binder or envelope. All work sheets should be maintained in an orderly sequence for easy reference. A binder or envelope is helpful in keeping work sheets in a presentable manner.

FORMAT OF WORK SHEETS. The following suggestions are given to aid the designer in properly utilizing his work sheets to best advanaage. These steps are considered to be minimum requirements.

1. Label each sheet. Each individual work sheet should have the following information written in a prominent location:
   a) Name or title of the project.
   b) Name of the designer.
   c) Date (month, day, and year).
   d) Page number on each work sheet.

2. Design work. All sketches and notes should be presented in a readable form, although precise lettering is not necessary. Notes should be complete to reflect the total thoughts of the designer during the period when his thinking was closely aligned with the problem, thus enabling him to retain his grasp of the problem. Skimpy or brief notes could require the expenditure of valuable time to rediscover lost concepts at a later date. General comments pertaining to an idea or sketch should become a part of the permanent record.

3. Work sheet accumulation. All work sheets should be preserved in a binder, folder, or envelope as an accurate record of all steps of the design process. Solutions to future or related problems may emerge from the design problem at hand.

   Preliminary notes and sketches are often included in the appendix of an engineering report to document the designer's approach to a final design. The application of these suggestions will be explained further in the examples that follow.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

A. Research and Design

ACTIVITY
2. "Retrieving Information"

Allow 2 class periods

OBJECTIVE: At the completion of this activity the student will have gone to the library and made a list of at least five (5) information sources which pertain to the problem and will have made a list of possible solutions to the problem, as evidenced by the completed assignment.

EQUIPMENT AND SUPPLIES NEEDED: Pencil and paper

REFERENCE MATERIAL: DESIGNING TODAY'S MANUFACTURED PRODUCT, Lindbeck, page 106 included
ENGINEERING DESIGN GRAPHICS, Earle, pages 70-71 & 75-77 included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show that research is a part of the design process.

   B. Research Ideas: Read reference material included.

      Other data sources:
      Technical magazines
      Manufacturing brochures
      General periodicals
      Patents
      Professional Consultants
      Survey methods
      Opinions
      Documentation ideas
      Brainstorming
      Experiments
      Observation

2. Student Assignment:
   A. Research in library and gather information reflecting these areas:
      Technological aspects of problem
      Marketing potential of solution
      Social effects of solution
      Related design
      Operational aspects of solution
      Physical characteristics and properties of possible solutions

   B. Bring information to class. Use a minimum of 5 sources. Include possible solutions to the problem.

Statement of the Problem

Because designing is a process which results in a solution to a specific need, the designer must obviously have a clear, simple, direct statement of the design task. The problem cannot be stated effectively in broad, vague generalities. It must be delimited and refined in such a manner that the novice designer knows precisely the end to which he must guide his efforts. If the problem is to design a chair, the undertaking should be limited to a chair to meet a specific need. If it is a lamp, the exact purpose for which the lamp is to be used must be known. A clear, definitive sentence describing the nature of the design task is called the statement of the problem.

Analysis and Research

Each design task is unique in that the solution must fulfill certain requirements. In analyzing the problem, questions must be posed and answers obtained. For example, the designer must know how and where a desk is to be used, how big it needs to be, and what materials and processes could possibly be utilized in its construction. In order to secure these answers, he must consult references, ask questions of individuals, and perhaps study other products of a similar nature to discover their weaknesses and shortcomings. Time must be given to reflect upon the intricacies and ramifications of the problem, for a truly creative solution demands such study and reflection. In short, activities such as these constitute a process of analysis and research, the second phase of the method.

ENGINEERING DESIGN GRAPHICS, Earle, pages 70, 71

4-1 General

The accumulation of preliminary ideas is the second major step of the design process. Graphical methods, and freehand sketching in particular, will be the primary means used by the designer in developing his ideas. The designer should have received a "feel" for the problem during the identification phase and will probably form several ideas for possible solutions as he lists the problem requirements. However, the designer should not allow himself to narrow his efforts to any preliminary ideas that might preclude other possible solutions.

The need for creativity and imagination is greater at the beginning of the design process than during later stages. The final steps of this design process are applied to the refinement and development of the initial ideas with little concern for developing new concepts. The need for a high level of creativity cannot be fulfilled unless the designer avoids negative thoughts. He must cultivate his ideas regardless of how radical they may appear to be initially. He must not attempt to evaluate his ideas at this stage, but instead, he should develop as many ideas as possible and record them with sketches and notes.

Page 71, 4-2

The designer who works independently must make as many sketches and notes as he would if he were working as a member of a team. In effect, he must communicate with himself through his sketches and notes. His ideas are recorded graphically with all pertinent notes and explanations. His primary goal is to obtain as many ideas as possible, on the assumption that the better ideas will be more likely to come from a long list than from a short list. He must avoid the temptation of becoming involved with a preliminary idea and attempting to develop it before he has listed as many alternative solutions as possible.

ENGINEERING DESIGN GRAPHICS, Earle, pages 75-77

4-4 Research Methods

Preliminary ideas can be obtained through research methods where a study is made of similar products and designs that were previously developed. Most design projects are closely related to existing designs which will provide the designer with ideas that can be modified to meet the needs of his problem; this process of applying known principles to new applications is called synthesis. There are many sources of references available that provide comparative design solutions for further analysis. Among these are technical magazines, manufacturers' produce brochures, current periodicals, patent records, and professional consultants.

Technical Magazines. Libraries contain numerous technical journals that review the current developments for the specific area of specialization covered by the publication. Excellent magazines are available to the engineer or technician at no charge through controlled circulation subscriptions. Such periodicals are supported by the advertisers of products used primarily by the subscribers for whom the periodical was published. Articles in technical periodicals often give complete detailed explanations of unique designs, complete with sketches and photographs. Such articles can be beneficial in supplying general ideas that may be applicable to a given design project. Advertisements in these journals can furnish information on materials and components that may be needed for a design solution. Additional technical specifications can be obtained from the manufacturer by letters.

Manufacturers' Brochures. All manufacturers of products sold on the commercial market put out literature that describes their product. Many of the brochures are quite elaborate and contain extensive information that would be helpful to a designer interested in reviewing related design solutions. Other manufacturers' brochures may be brief--three or four pages in length--but even brief brochures may be sufficient to stimulate a fresh idea. Manufacturers are most accommodating in supplying brochures free of charge upon request. Literature obtained through manufacturers should be retained in permanent files as a source for future reference. Also, many designs will require that certain stock components from manufacturers be combined into a systems design. Students working on a design project would benefit by writing manufacturers for brochures that could assist them with their design development.

General Periodicals. Significant design developments are usually reported in general-market periodicals, such as those subscribed to be most families. Magazines several years old may be as helpful to the designer as current issues in finding an idea. Attention should be directed toward the advertisements, since new products are usually presented in each issue. Advertisers are a source of the manufacturers' brochures mentioned above. Daily newspapers are equally valuable to the designer.

Patents. Patents on file in the U.S. Patent Office can provide many ideas and technical information that would assist the designer in his solution to a problem. Patents are a matter of public record and are available to anyone who desires to receive copies at a cost of 50 ¢ each. Figure 4-11 is a reproduction of Thomas Edison's patent illustration for the phonograph. Two pages of explanatory text accompany this patent.

A current record of newly issued patents is published weekly in the *Official Gazette*, which is published by the U.S. Patent Office. It contains a claim and selected figure of the drawings for each patent granted on that day; decisions in patent and trademark cases rendered by the Courts and the Patent Office; notices of patent and trademark suits; indexes of patents and patentees; list of patents available for license or sale; and much general information such as orders, notices, changes in rules, changes in classification, etc. This weekly publication costs $50 per year or $1.25 per single issue. Other manuals and documents are available through the Patent Office to assist the designer in reviewing patents and applying for patents. All correspondence concerning patent laws, subscriptions to the *Official Gazette*, and the ordering of patents should be directed to:

Commissioner of Patents
U.S. Patent Office
Washington, D.C. 20231

The designer or engineer can gain considerable benefit from reviewing patents. Not only will he receive helpful technical information, but he will also know whether or not his ideas are infringing on existing patents. The Patent Office provides a source of over 3,000,000 patents that can help the designer. Additional information on patents is included in Article 16-11.

Professional Consultants. The designer should learn to take advantage of the knowledge and experience of specialists as the need arises. Often his design will require an investigation of a field that is foreign to him, thus necessitating consultation with a specialist in this field. Such a person could provide guidance that could circumvent the necessity of rediscovering an existing system; he would also be familiart with methods that are readily available. A consultant may be a technician associated with the designer's firm, an engineer in his office, or any coworker who has a sufficient knowledge of the problem.

A professional consultant or consulting firm may be employed to provide assistance to the designer in reviewing possible solutions. A comprehensive design problem may require a team of specialists in structures, electronics, power systems, and instrumentation. Manufacturers' representatives are available for consultation to assist with many problems that are related to services and products provided by the manufacturers.

A student can get assistance with a design project from other students with appropriate backgrounds and from teachers of courses covering the areas of his need. In most communities there are many groups and individuals who can provide information that would conserve time and point toward a solution. Notes should be used to record points of discussion and conclusions reached during a conference with a consultant.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

A. Research and Design

ACTIVITY
3. "Describing Information"

Allow 1 class period

OBJECTIVE: At the completion of this activity the student will have described and evaluated the information retrieved as evidenced by the presentation of material to instructor for evaluation.

EQUIPMENT AND SUPPLIES NEEDED: Paper and pencil

REFERENCE MATERIAL: ENGINEERING DESIGN GRAPHICS, Earle, Pages 83-84 included
DESIGNING TODAY'S MANUFACTURED PRODUCT, Lindbeck, page 107 included
A DESIGNER'S NOTEBOOK, pages 3-39 not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show this process a logical way, to describe and evaluate new information for new ideas toward a solution to a problem.

   B. Study References Carefully.

2. Student Activity
   A. Compile and arrange the information retrieved in a logical order.

   B. List pertinent data that will tend to control (limitations) material, methods, construction details, projected characteristics (form) of the design problem.

ENGINEERING DESIGN GRAPHICS, Earle, pages 83-84

4-7 Documentation of Ideas

The designer should strive to maintain all of his preliminary sketches and notes. Preliminary ideas are important in the documentation of priority in the case of patents. Consequently, a standard format for design sheets should be used for the tabulation of preliminary ideas, and each sheet should be dated and noted with important information.

Sketching is the designer's most vital tool in developing preliminary ideas. Sketches can be very loosely drawn pictorials or sketches of the working-drawing variety.

The Transportable Uni-Lodge illustrates the value of sketches in developing and communicating complicated ideas. These sketches represent preliminary ideas for a transportable lodge that may become a reality by 1985. With helicopter service easily available, the Uni-Lodge could be transported to isolated or previously unreachable areas. There are retractable legs with pontoons that permit water travel. Special features: accommodates up to six people; has space for two weeks' food supply and for clothing and bedding; small tank and conversion unit provides water for drinking, shower and toilet facilities; solar power unit supplies electricity for cooking, air conditioning, refrigerator, two-way radio, and even TV. Most of these ideas were indicated on the sketches by means of notes as the ideas occurred. Pictorials and view drawings have been used in combination to depict the entire system. It would be impossible to communicate and develop these ideas without the benefit of sketching and graphical principles.

Possible Solutions

As possibilities for the design are visualized, they should be recorded as quick sketches for later analysis. These are the *possible solutions* to the design task. These graphic manifestations of the creative thinking process are the permanent visual record of the fleeting thought.

Sketches or drawings of possible solutions could be methodically prepared, carefully rendered or shaded, and accurately noted and dimensioned. At this point, however, there is much to be gained from quickly sketched "first impressions." Here the purpose is to record ideas with little regard for completeness or accuracy, with instances of the pencil literally moving faster than the mind. The result may be a most interesting and ingenious "accident," where the individual stumbles onto an excellent solution. The perfecting and correcting of these sketches can follow later, for the significant factor here is the creative idea.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

A. Research and Design

ACTIVITY
4. "Rough Sketching Ideas"

Allow 2 class periods

OBJECTIVE: At the completion of this activity the student will have completed rough sketched ideas as evidenced by the completed sketches.

EQUIPMENT AND SUPPLIES NEEDED: Pencil and pictorial grid paper

REFERENCE MATERIAL: DESIGNING TODAY'S MANUFACTURED PRODUCTS, Lindbeck, pages 129-150 included
THE WORLD OF DRAFTING, Ross, pages 25 to 58 not included
A DESIGNERS NOTEBOOK, pages 2-39 not included
ENGINEERING DESIGN GRAPHICS, page 72 included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show the process of transforming ideas into garphic form.

   B. Use basic geometric forms:

      Spheres
      Cones
      Ellipse
      Squares
      Prisms
      Cylinders
      Pyramid

   C. Design Factors:

Design	Physical
Contrast	Form
Balance	Size
Harmony	Color
Rhythm	Asthetic
Unity	Function
	Elements
	lines
	planes
	solids
	surface treatment
	Unity
	Variety
	Proportion

   D. Design Ideation:
      Put into other uses what is known.
      Modify
      Magnify

ACTIVITY
"Rough Sketching Ideas"

Minify
Substitute
Rearrange
Reverse
Combine

2. Teacher Demonstration
   Steps is Sketching:
   1. Visualize shape and proportion of object.
   2. Decide on pictorial position
   3. Decide on type of pictorial.

3. Student Activity
   A. Sketch ideas of solutions to teacher assigned problem on pictorial grid apper.
   B. Evaluate the designs and decide on two designs for refinement.

DESIGNING TODAY'S MANUFACTURED PRODUCTS, Lindbeck, pages 129-150

VISUAL ORGANIZATION THEORY

Man is by nature a creature of organization. As such, he finds himself incapable of existence and progress amidst chaos. Forward movement requires the measured step, the action based on logic and decision. Man is a creature of order because he is surrounded by it. There is order in the measure of time which gives control to his day; and in the rhythm of the seasons, there is order and logic to most of the significant tasks he performs. The precision of the solar system, of bodily functions, and of his mode of perception of objects all have contributed to man's penchant for propriety and organization. This factor is both a plague on his house and a source of immeasurable enjoyment.

While there are few rigid rules regarding man's attention to this orderly universe (for he is free to both dispute and refute it), he still finds himself compelled to attend to it. It is by no means an accident, therefore, that man's designs also reflect this feeling for order. Each physical unit in the universe is comprised of lines and shapes, forms, colors, and textures organized in such a manner as to provide objects both functional and beautiful. Without some measure of organization or order, a contemporary living room would be nothing more than a jumbled tangle of lines and forms. Instead, because of some undeniable law of order, design elements are arranged in such a manner as to build a visually pleasing totality. It is an examination of these arrangement theories and principles which forms the major topic of this chapter.

Design Elements

Man, the designer, communicates his ideas by manipulating visual symbols in much the same fashion as he employs letters in expressing himself in his written language. This language of vision has four basic symbols: lines, planes, forms, and surface qualities; and they are used to graphically represent design ideas. These are called, quite properly, *elements of design* because they are basic to every two- and three-dimensional object; they are the building blocks of all structures or forms.

A *line* is the path of a point moving through space; and because it has only this one dimension, direction is a most significant property. A line carefully drawn and controlled according to some specific plan marks the beginning of a good design. To the designer, it is one of the most important of the design elements. From a practical standpoint, lines are the connecting link between mental images and the resultant physical shape; lines based at intervals establish surfaces and determine form. All preliminary sketching and planning is accomplished with lines: outlines, contours, shapes, openings, appointments, and plane intersections.

Whether lines are straight or curved, their role in directing attention and determining form is a significant aspect. Such lines serve to suggest emotional feelings. A straight line is much stronger and has greater stability when compared with a curved line. Each curved line expresses beauty in its grace and elegance, though the feeling it creates is not necessarily one of strength, Curved lines arcing outward produce a sense of fullness and charm, whereas those that curve inward create a feeling of poverty and emptiness. Such curves are indicative of grace as reflected in a dignified candlestick,

lamp, or soaring arch. Straight lines, in turn, represent or suggest strength, vitality, stability, and security. Direction also plays a part here. A vertical line is noble and in balance, as suggestive in the towering strength of a tall tree. Diagonals convey movement and, when used alone and unsupported, they convey a sense of falling. This becomes a challenge to our sense of gravity, and from this emerges a feeling of movement which is accentuated as one creates sharp, jagged, lightening-like, or broken lines. In a sense, these lines lie in opposition to one another, and they tend to create discord or a harsh effect. Such an academic discussion of the quality of lines could continue on, but the point has been made. Lines serve to convey feelings and to determine basic shapes, and an appreciation of this fact will contribute much to the successful design.

Lines, in turn, are joinedor closed in order to create *planes or surfaces* which are the second of the design elements. Note the simple yet elegant forms created by closed lines as they are used to describe the shape of the furniture pieces in Fig. 4-6. These lines and planes further combine into the third element, *solid forms*, which give three-dimensional creations. Lines are, therefore, basic to all designing, and the resultant forms are limitless in variety. They can be simply geometrical or more contrived in contour as the elegant ceramic cookware in Fig. 4-8. Certain requirements for machine housings, for sporting goods, and for automobiles can dictate, to a certain extent, the utilitarian forms for these diverse products. While the functional considerations of a product will frequently dictate its formal qualities, it must be remembered that the options for form are limitless. Only an imaginative attention to the potentials of lines, planes, and solids as shapes, to evoke both senses of beauty and propriety, can serve to create the excellent design form.

The surfaces of the planes and solids can be enhanced, embellished, or changed by coloring and texturing. This becomes the fourth element, *surface quality*. Such surface treatment can add interest or emphasis to a design and thereby generally contribute to its appearance. The ability of a surface to reflect the light striking it is called *value*. White surfaces reflect all the light and lie at the top of a value scale. Black with theroretically no light-reflecting ability is at the bottom of the value scale, with all colors and tones falling between. And, indeed, color becomes a significant part of all well-designed products.

Individual reactions to color are frequently based upon past associations. By frequent identification with some idea, faith, or individual experience, color becomes symbolic. This explains why purple is usually associated with royalty, greenish-yellow with sickness and disease, blue with atmosphere, green with freshness and youth, white with purity, black with evil and terror, and yellow with sunshine and happiness. Furthermore, associations with basic foods have so conditioned people that they would not enjoy a meal of purple bread, green milk, or red potatoes. Studies in recent years have led to the realization that these identifications are not necessarily valid. Any color, if used properly, can have great esthetic appeal, a fact that is apparent in the recent use of more vivid and varied colors in clothing homes, and automobiles.

In addition to its esthetic appeal, color has a definite affect on other design elements. Certain combinations of color, for example, change the relative size relationships of adjoining areas or masses. Though shapes may be exactly the same size,

one can appear larger than another because of its color. Another type of illusion produced by color is an advancing and receding effect. When red (with yellow, a warm advancing color) is used with blue (with violet, a cold receding color), a three-dimensional effect is produced. And so, as suggested in the discussion of lines, colors, too, can produce certain emotional feelings and can, therefore, be used in conjunction with line to produce a desired effect upon the beholder. It is common knowledge that white or natural light is made up of all the colors of the rainbow, which is merely a separation of this natural light into the various spectrum colors by the atmosphere.

Specifically, how is color experienced? First of all, the sun radiates energy in the form of wavelengths. Sunlight contains all the colors of the spectrum, and each is expressed by wavelengths within a certain range. The light sources, such as the sun or artificial lamps, reach the object. In doing so, some light rays are absorbed and some reflected, depending upon the colors in the light source and color of the object. Only the reflected light is seen by the eye. Man mixes colors which will selectively absorb or reflect the specific hues in the right light rays. This is what he does when he paints an object a selected color. The eye defines the shape and color of the object by transforming the radiant energy into chemical energy, energizing nerve endings, and sending impulses to the optic nerve. The optic nerve registers the message and sends it to the sight center of the brain, at which point the individual becomes aware of the color of the object. This is a rather detailed explanation of what happens in color perception. The point is that man has succeeded in identifying and spearating these spectrum colors, and reproducing them with great accuracy in order to impart colors to objects.

In doing so, a number of different color systems have been evolved, the two common ones being the Prang and the Munsell. Shown in Fig. 4-13 is a color wheel based upon Prang system. Note that three primary and three secondary colors or *hues* are indicated. Pairs of adjacent colors on this wheel are known as *harmonious* hues. Colors opposite to each other are called *complementaries.* Man creates *tints* of these colors by adding white to one of the primaries. *Shades* are produced by mixing black with primary colors. The art of controlling surface color must be carefully studied by the designer as a means of increasing both contrast and interest in a product design. Color must be rated as a design element second only to line and form.

A second reflective quality of a surface is obtained with the property of *texture.* Texture is in actuality a pattern of contrast in light reflections that identify the surface rather than the shape of an object. Natural textures are the result of the characteristic structure of the material, such as the smoothness of an egg or the roughness of burlap cloth; and it is understandable that people often identify it with a sense of touch. Surface texture can be described as rough, smooth, velvety, or coarse, which are more indicative of the feel of the surface than of the visual impact. Every material has its characteristic texture and, as a result, texture as a property is helpful in identifying form. Not all textures are inherent or structural in nature. Some are the result of the method of manufacture, which imparts visual as well as functional qualities. Textures provide for better purchase, and offer scratch-resistant surfaces desirable in many products Therefore, in addition to this factor of surface enrichment, texture can play a functional role.

Metal and plastic sheets may be *embossed* to provide surfaces which are resistant to abrasive marking. Embossed surfaces on a gasoline pump may resist most scratches and scuffs that occur during normal use. These patterned sheets also find wide use in automotive door and instrument panels, luggage areas, seat-backs, and kickplates. There are many other applications to be found in architecture, aircraft, and appliances.

Textured control knobs can also offer a better gripping surface. Altogether too many dials and controls are difficult to operate because they are so smooth, especially if the attempt is made with moist or oily fingers. Simple surface texturing can overcome such functional deficiencies.

Design Principles

It has been said that a beautiful painting is to be looked at, but not talked about, a saying that reflects the difficulty of putting into words the emotions and feelings that exist in visual artistry. The professional designer is equally hard-pressed to describe the superior qualities of a well-designed industrial product. How can you remove one part from the whole and evaluate it as a separate entity? Although it is virtually impossible to thus break a design into components, or speak about some of the attributes common to well-designed things. Such characteristics are called *design principles* and they relate to the arrangement of the four elements of design into meaningful wholes. The most important of these principles are *unity* and *variety*, and *proportion* and *balance*.

Unity and Variety

Unity and variety are closely related, for within a design there must be a sense of belonging or similarity among the component parts in order to achieve wholeness. At the same time, there must be sufficient diversity or variety among the parts for the sake of interest. This is well-illustrated with the transistor radio in Fig. 4-19. Texture is achieved in the perforated aluminum fore-panel; this contrasts nicely with the smooth, black plastic case. Further interest is added by the sloping line visible in the side panel, a feature which relieves the monotony of the rectangular forms. These principles contribute to the means by which the overall effect of a design is analyzed. If a design has unity, it means that everything in it is woven together according to some well-developed scheme. The functional and esthetic relationships are thereby combined and balanced to make a complete, self-contained design.

These design principles relate to the broad range of art forms. For example, the principles of unity and variety are recongized as the essence of music, unity being achieved by the repetition of a basic theme, and variety by contrasting variations on this theme. A unifying motif runs through the course of Betthoven's *Fifth Symphony*, for example, which causes this musical piece to present a sensation of totality or wholeness; yet the monotony is relieved by contrasting musical structures. Compare this scheme with Fig. 4-20; see how monotony is relieved in a building tile structure. The same holds true in poetry, where the countermotion of phases provides a variation or contrast. Variety, then, implies the use of contrasting elements, so controlled and placed as to hold and retain attention. Variety means interest, the opposite of monotony.

Lindbeck, pages 129-150 cont.

The best examples of *rhythm* (which is another term for repetition or unity) are found in music as the listener hears the regular occurrence of beats which establish a definite pattern. The listener learns to anticipate what is to come from what has occurred. Painting, too, concerns itself with a rhythmic pattern of identical forms, and rhythmic patterns can also be observed in architecture. Such terms have meaning, to be sure, in these arts; and they have a similar meaning to the visual expression that lies in a product.

Balance and Proportion

Balance and *proportion* are two other familiar principles. Examination of the proportions in a painting reveals the visually correct relationships among the sizes of the forms on the canvas. The painting also achieves balance by weighing the bold, heavy line or form against another form of equal density in some other part of the painting. *Proportion*, as a principle, *deals with the relationship of the size of one part to the whole.* It is directly related to the concept of balance. *Balance is the quality of equilibrium achieved and sustained* through the proper proportioning of the parts of any whole. Ratios of approximately 1:3 or 2:3 are generally considered visually good.

Designs can be based upon proportion derived from the Golden Section. This system is attributed to the Greeks who devised it as a means of securing the pleasing proportions for their magnificent pieces of architecture and sculpture. Starting with a square, a radius is scribed about point (A) which bisects a side of the square. The sides of the newly formed rectangle have proportions of 1.618 to 1. The system can be repeated to secure a series of such proportionate rectangles. The arrangement of these forms can result in pieces which reflect the sensitive space divisions.

In design, proportion is one of the most effective means of creating unity among the various components. The use of proportionate elements, whether of lines, dimensions, areas, colors or textures, helps to establish a feeling of fullness and unity binding all elements together so tightly that removing or altering a single element would disturb the whole design.

Balance relates to proportion in that it is not only a biological necessity in our makeup, but also something we look for in all visual objects. What's more, people seem to be able to recognize this property easily. Balance which can be seen in an object is known as *optical balance.* When the two halves of an object are exactly alike on either side of an axis, the relation is known as *formal symmetry.* A design can also be symmetrical when organized radially around a center point. Wheel discs in automobiles are good examples of radial symmetry. However, balance need not be a strictly formal arrangement, for there is such a thing as informal symmetry in which balance is perceived just as surely as in the formal scheme.

Another interesting application of design principles is evident in the caster. Casters are used as rolling supporters for furniture or equipment that is frequently moved from place to place. Most casters are rather dull visually even though they may be fairly functional. However, in so many cases the material used in the wheels

is wood or hard rubber or plastic which flattens out through use or disuse. Others are so slick and slippery that they slide rather than roll across the floor. The purpose of a caster is to permit a piece of furniture to be moved conveniently and without scratching the floor. This caster is a striking display of unity and variety; the smooth transition from one element to another is quite remarkable. For example, the eye moves very easily and smoothly from the stem through to the supporting bracket and then to the wheel. There is no rough transition between the hub of this wheel and the firm, skidproof plastic which forms the tire. The elements are also well-balanced; they form a visually satisfactory whole by appearing as though they do, in fact, belong together. Functionally and esthetically, this is an excellent example of modern product design.

Sensitive, well-designed objects are never achieved by memorizing a long list of design principles and a second list of rules or generalizations reagrding their proper application. A designer does not set out to create a well-proportioned, well-balanced lamp. Neither does he consciously attempt to create a unified table nor a chair to exhibit variety. Instead, he embarks upon a design mission with an open, creative mind, searching for form, experimenting with combinations, sketching possible contours, seeking a solution that will reflect good organization of elements. Experience, practice, study, intuition, and reflection will lead to the ability to discriminate among sensitive and awkward forms. When this feeling of "rightness" about an object is present, the parts of a lamp will be in proportion, the table will look as though all the parts belong together, and the chair will display an interesting structural variety. If the feeling of rightness is absent, the lamp may appear top heavy; and the table and chair may appear so disorganized, busy jumbles of unrelated parts, inadequate products that man does not enjoy.

Put to Other Uses? New ways to use as is? Other uses if modified?

Modify? New twist? Change meaning, color, motion, sound, odor, form, shape? Other changes?

Magnify? What to add? More time? Greater frequence? Stronger? Higher? Longer? Thicker? Extra value? Plus ingredient? Duplicate? Multiply? Exaggerate?

Minify? What to subtract? Smaller? Condensed? Miniature? Lower? Shorter? Lighter? Omit? Streamline? Split up? Understate?

Substitute? Who else instead? What else instead? Other ingredient? Other material? Other process? Other power? Other place? Other approach? Other tone of voice?

Rearrange? Interchange components? Other pattern? Other layout? Other sequence? Transpose cause and effect? Change pace? Change schedule?

Reverse? Transpose positive and negative? How about opposites? Turn it backward? Turn it upside down? Reverse roles? Change shoes? Turn tables? Turn other cheek?

Combine? How about a blend, an assortment, an ensemble? Combine units? Combine purposes? Combine appeals? Combine ideas?

If the designer will ask himself these questions about each preliminary idea he develops, he will be able to expand his initial concepts.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
A. Research and Design

ACTIVITY
5. "Rendered Illustration of Solution"

Allow 3 class periods

OBJECTIVE: At the completion of this activity the student will have refined and added detail to the rough sketches (2) as evidenced by the completed refined sketches.

EQUIPMENT AND SUPPLIES NEEDED: Pencil or Magic Marker, illustration board, colored pencils, colored chalk

REFERENCE MATERIAL: ENGINEERING DESIGN GRAPHICS, Earle, pages 144-146 and 536-545 included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show that by correlating special materials, depth, and realism can be added to a drawing.

2. Teacher: Discuss basic rendering methods:
   line and shade
   pencil shade
   ink shade
   overlay film
   scratchboard
   airbrush

3. Teacher Demonstration
   A. Demonstrate rendering techniques.

4. Student Activity
   A. With media provided, strive for two professional quality rendering for presentation of most promising design.

ENGINEERING DESIGN GRAPHICS, Earle, pages 144-146

6-1 General

When a sufficient number of preliminary ideas have been accumulated in the form of sketches and notes, the designer can advance to the next step--design refinement. In design refinement it is necessary to make instrument drawings that are rendered to scale, to provide an accurate check on critical dimensions and measurements that were sketched during the early stages of the design process. When clearances or other measurements are critical, freehand sketches can be misleading. A scale drawing will give a true picture of the dimensions in question.

As we said in an earlier chapter, design refinement is the initial departure from the unrestricted freedom of creativity and imagination. Any design is subject to the limitations imposed by practicality of function and operation. Therefore, several better ideas must be selected and refined so that a comparison can be made during analysis and decision with regard to the final design solution to be implemented.

The designer must begin the analysis and decision functions to some extent during design refinement. He must select the preliminary ideas that have the most merit and are the most feasible in relation to the problem needs. Unless he makes a general analysis of the functional capabilities of the preliminary ideas, he will have to refine all of his designs, and this will require considerable time if he has drawn a number of preliminary ideas. Consequently, the designer needs to develop an ability to form opinions of preliminary ideas as they are conceived--but without becoming negative and restricting his freedom of imagination. These opinions will help him in selecting the preliminary ideas that are most worthy of refinement for further evaluation.

6-2 Determination of Physical Properties

The refinement stage of the design process is concerned primarily with the physical properties and general limitations that are evident prior to a formal analysis of a design. For example, scale drawings were made of three proposed configurations for the refinement of the "Big Joe" spacecraft. These scale drawings evolved from many preliminary sketches and design features of experimental vehicles previously tested to determine the most desirable characteristics. Scale drawings of this type are helpful in developing the final shape and dimensions of a design. The functions and activities of the astronauts to be housed in the craft will have considerable influence on the size, volume, and general configuration of the capsule. Human engineering factors will be discussed in greater detail in Chapter 13. To determine the weight of the craft it is necessary to know the surface areas of the vehicle parts and the types of material used. Interior components and other equipment must be known also, as well as the approximate weight of the passengers. The volume of the craft must be determined to ensure that sufficient space is available for the accessory equipment required during flight.

The calculation of practically any given physical properties begins with basic geometric elements--points, lines, areas, volumes, and angles. The measurements of these elements are determined as a design is refined prior to the preparation of working drawings from which the object can be constructed. The refined design is

Earle, pages 144-146

is not necessarily a working drawing, but it is a scale drawing from which a rather accurate appraisal can be made.

Design refinement may involve a three-dimensional problem requiring spatial analysis. It may also involve planning for the use of stock components

ENGINEERING DESIGN GRAPHICS, Earle, pages 482–484
16-1 Introduction

A good design solution must be accepted before it can be produced; and acceptance, in many cases, will hinge on the skill with which the design is presented. The design process has progressed to its present stage from a roughly outlined set of circumstances that suggested the need for a solution. The designer investigated the background of the problem and the factors affecting it to determine whether the problem was actually in need of a solution and what general type of solution was needed. He then developed preliminary solutions, refined them, determined specific measurements, analyzed his better designs, and has now arrived at the point where he feels qualified to present his design with his recommendations. This is the decision stage of the design process.

By this time, the designer has a complete understanding of the problem, the data and information affecting this thinking, experience with regard to ideas that will not work as well as others, and reasons for his suggested solution. His familiarity with the problem can, in fact, be a handicap to him during the presentation process, because those with whom he is dealing may have only a minimum of background information, and his presentation may not include a sufficiently complete review of the problem and the reasons that made him arrive at a specific solution. However, his associates who are responsible for accepting his proposal for volume production or the expenditure of large sums of capital must have access to a summary of the problem and the reason for the designer's final solution in order to make an informal decision based on facts or experience.

Presentation for the decision phase of the design process can be called the climax of the designer's work. A well-prepared, effectively given presentation will increase the chance for a design to be accepted for further development or immediate implementation. On the other hand, an inferior presentation may kill a superior design; in this case, the preliminary effort invested in the project may be lost.

This type of presentation is referred to as presentation for *decision.* Although decisions on the acceptance of a completed design will usually be made by a group of people, in some cases it will be the *designer* who will make the decision. The process of presentation is much the same in this case; however, the methods used will vary.

The other type of presentation is the presentation for *implementation*--for augmenting a design once a favorable decision has been reached. This will involve all methods available for presenting specifications, working drawings, schematics, diagrams, etc., that completely describe the implementation of the completed design. The two types of presentation introduced in this chapter, presentation for decision and presentation for implementation, will be discussed in greater detail in Chapters 18 and 19.

ENGINEERING DESIGN GRAPHICS, Earle, pages 483-484

16-2 The Designer's Presentation to Himself

On small design projects, the designer himself may have to decide whether or not to accept a design. He will have to review the project in his own mind. Although he may not necessarily prepare charts and other visual aids as he would if he were giving a formal presentation, he must, nevertheless, have access to the same information and data for his own evaluation as would be required in a formal presentation. The designer can easily lose sight of important features and points throughout the design process without realizing the oversight. Consequently, he should frequently refer to early worksheets and preliminary ideas throughout the design sequence to ensure that no idea has been overlooked. All worksheets, should be kept as a permanent record of the designer's progress in arriving at the finished design.

When he has narrowed his final solutions to several designs, he must decide which one to accept for implementation. At times, the solution arrived at may turn out to be neither economically feasible nor sensible; in this case, the designer will regard his findings as valuable background for future projects of a similar nature. Cases of this sort are likely to arise in experimental design projects that are conducted as a form of research.

Although the designer is completely familiar with his project after working with it for a period of time, he will not want to make a final decision without reviewing the entire list of alternatives. A good way for a designer to make a decision is to communicate with himself through sketches, data, notes, or models. He will begin his review by making a list of the favorable features of each design solution and a similar list of the unfavorable features.

Previously gathered data should be evaluated in conjunction with each design solution. Market research data will indicate the price range that would be most acceptable for a product of this type. The consumer's activity when using the hunting seat will affect the designer's decision. Will the hunter walk for long distances carrying the seat and hunting equipment or will he travel by vehicle most of the way? Will he be able to climb a tree or is a self-hoisting mechanism needed? The average age of the hunter for which the seat was designed will answer these questions in part. Older hunters will probably need more comfort, walk less, and be less adept at climbing trees. Available data should be plotted in the form of a graph to allow easy interpretation. This information should be added to the list of features of each design. At this point the designer can arrive at his decision.

The designer has been actually communicating with himself by employing graphical methods for recalling his ideas. He may even make pictorial sketches to explain his refined designs more fully to himself. Often it is easier to analyze a pictorial than a two-dimensional orthographic drawing. Principles of pictorial drawing will be covered in Chapter 17; these will be of assistance in presentation for decision and for implementation.

The most realistic means of evaluating a design is through a scale model or a prototype, as covered in Chapter 13. Such a model is invaluable in studying features and operational methods to eliminate doubt as to a product's function and other characteristics. Models need not be complicated or expensive to serve their purpose.

Earle, pages 483-484

Commonly available model materials, including balsa wood and even paper, often are sufficient to provide a better understanding of the proposed design. An example of a student model is given in Fig. 16-2, which shows a home-caddy model that demonstrates the functional characteristics of the design. This model was relatively inexpensive to construct but was effective in suggesting further improvements. Models are certainly necessary to the designer in communicating his ideas to others, but they are also valuable for communicating with himself. He is better able to understand his own ideas and to review his design concepts. The design of any product involving a close contact with the human body should be rendered as a full-size model if at all possible to establish the optimum dimensions and other comfort factors that cannot be evaluated without actual testing.

SECTION III. SYNTHESIS THROUGH PRODUCT DESIGN
A. Research and Design

ACTIVITY
6. "Model Building"

Allow 3 class periods

OBJECTIVE: At the completion of this activity the student will have demonstrated a knowledge of how to build a model as evidenced by the completed design model.

EQUIPMENT AND SUPPLIES NEEDED: Glue, sandpaper, paint, foam, paper, cardboard, wood, textiles, fiber sheet metal, clay, etc. Hand tools to work with materials.

REFERENCE MATERIAL: EXPLORING DRAFTING—basic fundamentals, Walker, pages 265-273 included
ENGINEERING DESIGN GRAPHICS, pages 371-377 included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show the three dimensional method of visually conveying an idea.

   B. Review references carefully.

2. Student Activity
   A. Build model and paint. Mount on base and provide environmental surroundings to illustrate how model would look.

EXPLORING DRAFTING--basic fundamentals, Walker, pages 265-273

MODELS, MOCKUPS, AND PROTOTYPES

To many people, modelmaking is an interesting hobby. You probably have made models of famous planes, boats, or cars from wood or plastic.

Industry makes extensive use of three modelmaking activities--MODELS, MOCKUPS AND PROTOTYPES. These are used for engineering, educational and planning purposes. Models have proved to be very helpful in solving design problems and to check the workability of a design or idea before it is put into production.

What is industry's definition of a model, mockup and prototype? In general, the following applies:

MODEL. A scale replica of a planned or existing object. The model may be constructed to see how the product will look, to check out scientific theory, demonstrate ideas or for training or advertising purposes.

MOCKUP. A full size three-dimemsional copy of an object. This is usually made of plywood, plaster, clay, fiber glass, plaster or a combination of materials.

PROTOTYPE. A full size operating model of the production item. It is usually handcrafted to check out and eliminate possible design and production "bugs."

How Models, Mockups and Prototypes are Used.

Many industries employ models, mockups and prototypes for design tools. A few of the more important applications are:

Automotive Industry

The automotive industry places great importance on the use of models, mockups, and prototypes. Mistakes can be very costly.

An automobile starts "life" as a series of sketches. These are usually developed around specifications supplied by management. Promising sketches are usually drawn full size for additional evaluation.

Clay models are used for three-dimensional studies. Upon the completion of further design development, a fiber glass prototype is usually constructed.

Production fixtures (devices to hold body panels and other parts while they are welded together) and other tools needed are developed from accurate full size wood and plaster models.

After many months of development and production planning, manufacturers are ready to make new model automobiles available to the public.

Walker, pages 265-273

Aerospace Applications

The tremendous cost of aerospace vehicles makes it mandatory that they first be developed in model and mockup form.

Flight characteristics can be determined with considerable accuracy without endangering human life, by testing complicated models in a wind tunnel or in free flight.

Exploration of the moon was first planned with models.

Prototype aircraft are the first two or three preproduction planes (usually handcrafted) that are flown to check the data obtained from wind tunnel research and to secure a license for that particular type plane.

Architecuture

You have seen photos of proposed buildings in the real estate section of your Sunday paper. Some of these illustrations were of models that were very accurate miniature replicas of the proposed buildings.

Many people use models when planning a new home. This helps them to visualize how the house will look when completed. The model enables the owner to see the completed design in three dimensions and also how paint colors and shrubbery plantings will look.

Ship Building

Ship hulls are tested in model form before designs are finalized and construction starts. Specially designed equipment tows the model hull through the water in the test basin. The model hull behaves like the full size ship so design faults can be located and corrected.

City planning

Most large cities use scale models to show city officials and planners how proposed changes and future developments will look. Models, while rather costly, permit intelligent decisions to be made before large sums of money are spent acquiring land and existing buildings are torn down.

Construction Engineering

Many construction projects are designed from carefully constructed models. By working from models, engineers can see how space can best be utilized. In some instances, they can determine how the proposed project will affect the surrounding community. This helps to minimize field problems and changes during construction.

Walker, pages 265-273

Models may also be used to train personnel in plant operation.

Construction Models

Model making materials are readily available commercially. Many products made for model railroader are ideally suited for making architectural models. Kits are available for the small home builder who wants to design his own home.

A professional touch can be added to models by using accurately scaled furniture, automobiles and figures that can be purchased at toy and hobby shops.

Preprinted sheets of brick and stone can be glued to a suitable thickness of balsa wood for walls and partitions. Various types of abrasive paper are suitable for roofing, driveways, and walkways. Simulated window glass can be made from transparent plastic sheet. Several different scale sizes of window and door frames are available molded in plastic. Most model shops can supply bushes and trees in various types and sizes.

Other types of models--autos, planes and boats, are made from bass wood, mahogany, balsa wood, metal, plaster, and various kinds of plastics.

Regular model making paint is produced in hundreds of colors and is ideal for painting all types of models. However, care must be exercised when painting models that have plastic in their construction. Be sure the paints used are designed for plastics. If you are not sure, paint a small portion of the plastic that is hidden from view to determine whether the paint is compatible with the material.

Models may be assembled with model airplane cement or the white glues. . . Elmer's, Titebond, etc.

ENGINEERING DESIGN GRAPHICS, Earle, pages 371-377

13-9 MODELS

Models are effective aids not only in analyzing a design in preliminary stages, but also in presenting the finished product or system in a three-dimensional form for easy comprehension. A design should be studied for proportion, operation, size, function, and efficiency through scale models, which can vary from a fraction of the actual size to models that are several times larger than the actual size, in the case of small mechanisms. The model is a three-dimensional form translated from drawings that were originated as mental concepts.

The analysis of a model can be used to determine clearances or relationships that affect the interaction between parts. A better idea of proportions can be determined when the actual-size design is studied respective to its use by constructing a full-scale mock-up. Actual components of the proposed design can be constructed and tested under repetitive tests to determine the strength capabilities and the fatigue limits of the design. Data gathered from experimental tests can be used to predict the probability of success of a given design. This method of analysis will be discussed in Chapter 15.

Models will vary in scale and in the detail of presentation, depending on the purpose of the model. The materials can also vary from paper and balsa wood to the actual specified materials. In general, the basic types of models are:

1. Preliminary models
2. Scale models
3. Mock-ups
4. Prototypes
5. System layout models

PRELIMINARY MODELS. A preliminary model is a rough model that is made by the designer at any stage of the design process to help him analyze a design feature. Models of this type are primarily for the designer's own use rather than as a means of presenting his ideas. Preliminary models may incorporate only a single feature of the total design to gain a better understanding of its shape, operation, or fabrication; they can be made of any material.

SCALE MODELS. Scale models are constructed for analysis or for the presentation of a refined design. Balsa wood and the usual model materials can be used to good advantage in developing a scale model. The scale selected should be sufficiently large to permit the operations and movements of the design to be demonstrated.

MOCK–UPS. Mock-ups are full-size "dummies" of the finished design that will give the general appearance of the total product. Mock-ups are constructed more for size, shape, appearance, and component relationships than for operational movements. Modifications in size and configuration can be determined by studying the full-size mock-up.

PROTOTYPES. A prototype is a full-size working model that follows the final specifications in all respects. The only exceptions may be in the use of materials. A prototype is made mostly by hand prior to acceptance for mass production; consequently, materials that are easier to fabricate by hand are used in place of those that will be used in final production. The prototype is the last chance for variation in design. Sometimes prototypes of an operational design provide data that can be used for analysis, as will be discussed in Chapter 15.

SYSTEM LAYOUT MODELS. System layout models are a special kind of scale model, and are used to show relationships between buildings, manufacturing systems, traffic systems, or industrial processes. Models of refineries are often constructed to supplement working drawings during construction. Models of this type are also used to help the designer determine the clearances necessary for a functional system. Photographs of detailed sections of models can be superimposed on working drawings to explain certain complicated features that would otherwise require considerable study for comprehension.

The scale selected for the system layout model will depend on the purpose of the finished model. If the model will show only a general relationship between buildings or large structures, a rather small scale of about 1/16" per foot or less is used. If the model is to be used for accurate analysis of clearance between related parts that will be in the final design, the scale should be somewhat larger. The scale model of the Hoover Dam was used for analysis and presentation to describe the final appearance of the dam and the surrounding terrain.

Interiors of manufacturing plants or other architectural interior systems are built at a scale of ¼" per foot. These models conform to the usual scale used in the working drawings. Architectural models can be built from commercially available components that add realism and reduce model construction time.

13-10 MODEL CONSTRUCTION

The student should develop preliminary models as a means of evaluating his design and analyzing its function. The same models can be used to aid in the decision process (Chapter 18), when the design concept is presented to a group. Models can give a designer a "feel" for scale, appearance, and proportion that cannot be achieved through other methods. Models prepared by students to represent design solutions can be made with a minimum of expense.

MODEL MATERIALS. Most communities have model supply dealers who will probably be able to furnish most of the materials required for a student model. Balsa wood is commonly used in such models because it can be easily shaped as desired, with the minimum of equipment. Razor blades and simple model tools are more than ample for model construction with balsa wood, and balsa-wood parts can be easily glued to form completed shapes.

Standard parts such as wheels, tubing, scale figures, dowels, and other structural shapes used in model construction can be purchased commercially to reduce construction time and effort. The designer may need some special parts that cannot be found

in the model shop. In some cases, he can find the appropriate components, wheels, or mechanisms on a readily available toy that can be purchased at a nominal cost. There are few set rules as to how the model builder should achieve his completed model, so this entire area is open to his innovation and imagination.

Other workable materials that can be used for models are aluminum, clay and plaster, and wood. Aluminum sheets and tubing are usually used for special components rather than for an entire model. Clay and plaster are effective in molding a plastic shape. Plywood and solid wood have many applications in larger models and in working models which have movable parts. Wood, even a soft wood like pine, requires more specialized tools than balsa wood since it is considerably harder and is therefore more difficult to carve or cut.

When they are to be used in the presentation portion of the design process, models should be finished to give a faithful impression of the finished design. In other cases, such as when the model is constructed to analyze function, this will not be as important. An excellent example of a model that is both functional and representative of the final design is the Mariner model, which is constructed at 1/8-size. Details are shown to completely explain all portions of the design. Student models can effectively be finished by sanding all surfaces and painting the model to simulate the materials that will be used in the final product.

MODEL SCALE. The scale selected by the designer will have a significant effect on the final result and the value of his model. A model that is used to analyze moving parts of a functional product should be scaled such that the smallest moving part may be analyzed. Although this model is relatively small, the linkage system can be operated in the same way as in the completed product. As a general rule, models should be constructed to be at least 12" in overall size. By necessity, models of system need to be considerably larger to depict sufficient detail.

MODEL ANALYSIS. A student model of the hunting seat introduced in Chapter 2 is shown in its preliminary form in Fig. 13-50. It was constructed of canvas and aluminum scraps obtained from a local manufacturer; the design specifies that the final product also be made of aluminum and canvas. Details of fabrication that could be improved or modified became apparent from studying this scale model. These changes were incorporated in the full-scale prototype shown in Fig. 13-51. Human factors affecting the comfort and function of the seat could be identified by testing the model in actual use. A secondary use of the seat as a back pack could also be studied for comfort as could the method of securing the pack to the hunter's back (Fig. 13-52). The system of anchoring the seat to the tree could be tested and modified by actual application, a necessity since this could not be determined otherwise with complete assurance. Manufacturing methods of assembling and fabricating the seats are easily improved upon when the completed model was available at the time of consultation with manufacturer's representatives, who are experienced in mass-production.

Models can also be used to test the consumer's reaction to a new product before proceeding with production. Although drawings, photographs, and artistic sketches are helpful in communicating concepts to the general public, the true test of acceptance

can come only from reaction to the actual product. As we mentioned previously, it is advantageous to present more than one design to the public to determine preferences for details that would influence the mass production of the product.

A student will find it a profitable experience to carry his design from his initial mental concept through the appropriate drawings to a completed scale model that will demonstrate his design in a tangible form. By this process he will gain exposure to as much of the complete design process as he can without actually being involved in a manufacturing situation. The development of a finished, working model requires that he cope successfully with design problems during the formulation stage; otherwise his design will not function. With this as a test of his effort, he approaches his design under realistic conditions which will provide challenges similar to those he will encounter as a practicing engineer.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
A. Research and Design

ACTIVITY
7. "Experiment and Evaluate Design"

Allow 2 class periods

OBJECTIVE: At the completion of this activity the student will have learned how to experiment with and evaluate a design, and how to make the necessary changes in the design as evidenced by the observation by the instructor.

EQUIPMENT AND SUPPLIES NEEDED: Pencil

REFERENCE MATERIAL: PRODUCTION DESIGN AND DECISION THEORY, Starr-Prentice Hall, pages 1-4 included
ENGINEERING DESIGN GRAPHICS, Earle, pages 354-371 not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show a logical objective method to evaluate a product.

   B. Design anaylsis: Evaluation may be defined as any method by which deficiencies in solutions to design problems can be detected before first manufacturing drawings have been started and production begun.

   The evidence of advancement in our understanding of physical process are evident by all.. Engineering science moves forward and the results are translated into concrete representations such as bridges, buildings, FM radios, nuclear reactors, space probes, etc. Each require careful deliberation. A variety of considerations--not just technological factors--affect the final forms of respective designs. In every case the particular elements of the decision system are different.

   Technological advances and the changes that they motivate with the methodical system of design decision making should not be confused. Since there are so many possible ways to arrive at the apparent goals of design decision, each of these ways become an alternative strategy. Difference in shape, form, and materials are a few of the variants encountered. The decision is to choose the strategy which best satisfies the decision makers objectives. If different executives hold differing objectives each is in a position to influence the final decision. Here compromises must result. The basic overriding objective of all should be identical, but because of an inability to communicate with each other, because of logical inconsistencies with other human failings objectives held are different.

   Therefore, a design decision is a very complex problem. How does one distinguish between good and bad decisions and at the same time improve the quality of the process used in achieving design decisions?

   The analysis process is characterized by objective thinking and the application of factual information. The general areas of analysis can be delineated as:

ACTIVITY
"Experiment and Evaluate Design"

1. Human engineering
   Man uses the product, therefore, physical, mental, and emotional characteristics of the use must be considered which serve man best.

2. Market and product analysis
   Deals with public acceptance and quanity needed

3. Prototype and model analysis
   Study design for porportion, operation size, function, and efficiency by visual inspection.

4. Physical quanities
   Physical description of product which affect practicality of design as determined by lengths, areas, shapes, angles, weight, volume, and types of materials used. Was maximum strength minimum weight utilized.

5. Strength analysis
   Strength is closely associated with function, if the design is not adequate to withstand stresses the product becomes useless.

6. Funcual analysis (most important)
   One that works best under most varying conditions.

7. Economic analysis
   Cost of engineering projects is always a major factor, since industry has a profit motive. Therefore, materials, labor, fabrication processes reflect the total cost of the design product.

Engineering analysis which requires the application of scientific and physical principles are very important at this stage, therefore, he must have a general background in the areas of science, physics, mathematics and other disciplines of engineering science to decide on the most promising design.

The traditional method of evaluating designs is by judgement, and by reference to the experiences of engineers and draftsman. However, objective analysis enters in to the final decision and is a large prop action of the performance specifications of the design evaluation. The task then is to devise tests, charts, trials, and other methods by which each design may be checked against each performance requirement.

2. Student Activity
   Using the evaluation form, evaluate the product design of a classmates design solution and rank items in relation to the particular design characteristic for production. Rank from 0 to 10 with 0 representing the lowest or poorest characteristic and 10 representing the highest or best characteristic. If the design is not approved, alternative constructive design changes will be suggested. Further experimentation may be done within guideline of alternative suggestions.

PRODUCTION DESIGN AND DECISION THEORY, Starr, pages 1-4

The Nature of Produce Design Decisions

The evidences of advancement in our understanding of physical processes are ubiquitous. Engineering science moves forward and the results are translated into concrete representations such as bridges, buildings, FM radios, TV transmitters and receivers, nuclear reactors, and space probes.

Each of the items mentioned above required careful deliberation. A variety of considerations--not just technological factors--affected the final forms of the respective designs. In every case the particular elements of the decision system would be different. Economic, political, and social considerations, interacting in complex ways with technological potentialities, produce decision patterns that are unique for a specific product design at a given moment in time. The result is a family of designs within each product class; there are, for example, many varieties of FM radios. To understand the nature of this diversity we must investigate the system of decision that produces it.

1. What is a Design Decision?

It is very important that we do not confuse technological advances and the changes that they motivate with the methodological system that underlies design decision-making. The former has been continually advancing but the latter has not kept pace. There are several good reasons to suppose that the preceding statement is accurate. However, we will have the opportunity at a later point in this section to develop the justification for this belief. First, let us examine what is meant by a design decision.

Given a function to be performed. Then, in general, a number of possible ways to achieve this goal becomes apparent. Using the language of decision theory, each of these ways or capabilities is an alternative strategy. Differences in tolerances, materials used, shape, and form are just a few of the usual variants that are encountered. The decision problem is to choose that strategy which best satisfies the decision maker's objectives. If the designer does not know what objectives apply, then only by fortuitous selection can he succeed. If various executives of the company hold differing objectives and each of them is in a position to influence the final design, then varying degrees of chaos can result. Under some circumstances we call this state of affairs compromise. It is unfortunate that frequently compromise occurs when no compromise is required. The basic and overriding objective of all the individuals concerned should be identical, but because of an inability to communicate with each other, because of logical inconsistencies and other human failings, it would appear that the objectives held are different.

A design decision is, therefore, a very complex problem. Recognition that the decision process requires that a single strategy must be chosen from a number of alternatives begins to structure our thinking, but it does not explain how that selection is to be made. In other words, how are these decisions rendered? We must attempt to identify the process and to examine the elements of that process. We must find a means to discriminate between "good" and "bad" decisions. At the same time, we must try to improve the quality of the process used for achieving

design decisions. Since an actual decision process is involved, our attention must be centered on the procedure by means of which design decisions are reached. The design of a particular product becomes in these terms one application of a basic procedure.

All of this is apparent as soon as we acknowledge the obvious fact that the final form of a product design is not pre-determined. It is basic to the nature of design decisions that the number of possible variations that can evolve from a given technological system is too large to permit all of the variants to be considered. This is true whether a formal and rational method is used or a strictly intuitive one Each has its place in the decision process. Until we recognize the existence of the process by means of which decisions are reached we can hardly expect to know when to use one and when to use the other. We cannot specify what kinds of information are relevant. We cannot clarify disagreements that might undermine the entire product design program. We cannot hope to achieve the company's objectives.

There is a good deal of empirical evidence that the decision process commonly used is not satisfactory. The very high rate of new product failures, products which enter their market but are withdrawn within a short time, is an excellent case in point. The costs of such failures are high, both in lost investment and in lost opportunities.

Opportunity costs are more elusive than accounting costs. Simply stated, if the wrong strategy is chosen, then a lesser attainment of the objectives has resulted. The lesser attainment of the objectives has resulted. The statement is tautological, but necessary. In terms of the objectives, the amount of the difference between the actual attainment and the best possible attainment that could have been achieved is called the opportunity cost. Therefore, a company which fails with a new product must consider not only the lost investment, but also the cost of the lost opportunities due to not having used that investment in another way. Instead of failing with product x, a smashing success might have been achieved with product y. Very rarely are the fundamental technological assumptions at fault. Instead, it is the decision system that was used to determine how to put the technology to work that has failed us.

There is also a logical reason for believing that the decision process that is commonly used is not satisfactory. Over the years, the methods that we employ to reach product design decisions have remained essentially unchanged. Meanwhile, the decision problems have continually grown in size. The number of usable materials, the availability of alternative production processes, the requirements for variety in size, shape, and color, the range of possible qualities as expressed in tolerance specifications and surface finishes, the number of different kinds of users--these and other factors justify the statement that the size of the decision problem has been continually increasing.

Briefly, let us consider a very simple problem in order to develop a common understanding of the nature of the factors that are at work. Our problem is whether to use plastic or metal for a particular product design. We will assume that a broad range of both materials could successfully (in a technological sense) be

utilized. Each material will have a basic price and its own particular discount structure; the cost of working each material will differ; varying amounts of waste will result. The frequency of encountering defectives will be a function of both the material and the process that is used. Different tolerances will be available. Failure rates and types of failures will affect the kind of guarantees that can be offered. Performance effectiveness and the way in which this drifts from a standard over time will create important differences in the way that the product is viewed. Shipping weights and consequently shipping costs will differ. Possible varieties of color, surface, and perhaps size and shape will seldom be the same. They will certainly not produce identical cost schedules. Inventory policies will vary as a result of the cost of the material, its spoilage rate, the vendor's lead time and reliability, and many other factors. Production schedules will also be affected. But most significant of all, the market might change because the material is different. This difference, reflected in terms of appearance, variety, guarantee period, distribution, availability, price, and in numerous other ways, will elicit appeal from different groups of consumers. Next, in this simplified version of our decision problem, we must consider the competitors and their effect. What are their products like and how might they change them as a result of our actions? Their decisions will affect our production rates and the consequent choice that we can make of the equipment that is to be used. They may also affect the quantity discount that can be obtained. It is quite clear that the potential size of these decision problems is gigantic. If we further include the effects of changes in the economy, the possibilities of strikes at our own, competitors' and vendors' plants, the dynamism and unpredictability of consumer taste patterns, the impact of marketing strategies (both our own and our competitors') as they are realized in promotion and advertising, and the likelihood of international competition, we succeed in merely adding a few more dimensions of reality, not in capturing the total essence of the problem.

DESIGN EVALUATION FORM

Product Characteristic	0	1	2	3	4	5	6	7	8	8	10
Function											
Reliability											
Life Expectancy											
Uses Standard Parts											
Ease of Assembly											
Availability of Materials											
Selection of Materials											
Appearance											
Staying with Constraints of Prepared Factors											
Cost/Unit of Production											
Safety											
Effect on Environment											
Effect of Environment											
Maintenance											
Use of Present Manufacturing Processes											
Efficiency of Materials											
Strength											
Design Proportion											

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
A. Research and Design

ACTIVITY
S. "Reporting to Management"

Allow 2 class periods

OBJECTIVE: At the completion of this activity the student will have demonstrated his knowledge of how reports are made to management as evidenced by the completion of a presentation to the class.

EQUIPMENT AND SUPPLIES NEEDED: Paper and pencil

REFERENCE MATERIAL: "Engineering Graphics," Feb. 6, 1967, included
ENGINEERING DESIGN GRAPHICS, pages 494-491 not included
DRAFTING TECHNOLOGY & PRACTICE, Spence, Bennett Pub. Co., pages 226-248, 726-756, not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show management is kept informed of the progress of new design products.

   B. The collection and analysis of the data on existing and new products must be the first step in preparing to write a capital expenditure request. This should be collected and understood for presenting to top management. On new products which are to be implemented, it is imperative to show management the proposed investment and decide what is the best way to achieve the approvement of the company. When presented with the full story, top management will be able to make the best decision for the company.

   When an investment is proposed, management needs to know how sound this investment is and whether this is sufficient to justify the expenditure.

   Capitol investment is needed by companies to expand the capabilities of its business and provide the base from which additional sales and profits can be achieved. Top management makes the final decision between the alternatives presented with questions such as:

      1. Does this investment move us into the product and market direction desired by our corporation?
      2. Is this a profitable way to go?
      3. Does this particular product fit the master plan?

   The collection and analysis of the data on the existing system is the first step in preparing to write a capital expenditure request. This data is collected so that the presenter has a complete understanding of the product to be changed or added in order to present this picture to top management. When you understand the present products, etc. you want to see implemented you need to show that the proposed investment is the best way to achieve that improvement in the product.

ACTIVITY
"Reporting to Management"

Once the data has been collected and analyized the request for capital is now ready to be written. A format provides a method to present concise and complete information. When all sections are complete and necessary attachments prepared, the complete story and request should be written for the person who will give first approval to the project.

Presentation for Decision

Presentation Phase--(10 minutes)
Individual presentation
Group presentation

Organizing presentation:
Select order and type of presentation (See Presentation Format enclosed)

Visuals:
1. Drawings
   - Isometrics
   - Obliques
   - Axionometric projection
   - Illustration
2. Display
3. Flip chart
4. Paper
5. Color
6. Slide
7. Photographs
8. Slide-script
9. Transparencies
10. Models

Oral and/or written presentation:
Review problem
Distribute handouts (Technical reports, research data, etc.)
State objectives of presentation
Present design solution or recommendation
Present weakness but offset by alternatives to compensate
Present strong points
Present recommendations
Conclusion

Question/answer period

2. Student Activity
Complete the Produce Design Approval Format to correctly describe the information necessary to properly describe the product.

When completed the proposal information will be personally presented to management (class) for project approval for one of the proposed designs.

Use Rendered illustration with presentation. Management makes the decision on which to produce or makes recommended changes.

PRODUCT DESIGN APPROVAL FORMAT

Product Title_____
Date_____ Prepared by_____

I. Statement of Request.

II. Description of Product

III. Need for Product

IV. Present Product

V. Capital Distribution

VI. Working Capital

VII. Financial Returns

VIII. Timing

IX. Alternate Approach

X. Approval

Manager
Date

Presentation Format

REQUEST FOR PRODUCT DESIGN APPROVAL

Product Title_____
Date_____ Prepared by_____

I. Statement of Request:
(Purpose of request)
(Show how much and what for)

II. Description of Product
(Mention main features and factors)

III. Need for product
(Show that product will sell and there is a need for it.)
Tell about projected sales and function of product.

IV. Present product
(Describe and compare it with other products)
Size
Shape
Materials
Other

V. Capital Distribtuion
(Show projected cost of each production unit, show projected cost ofman-hours of each production unit, show projected cost of machine hours of each production unit)
Total capital expenditure

VI. Working Capital
(Show change if any of additional cost)

VII. Financial Return
(Show how money invested for product will give returns on investment and percentage returns for one year, five years, and ten years)

VIII. Timing
(Tell when product can be on market and give time schedule from date of approval to distribution of product)

IX. Alternate Approach
(List good and bad points to go)

X. Approvals:

Manager _____
Date _____

SECTION III, SYNTHESIS THROUGH PRODUCT DEVELOPMENT
B. Technical Preparation

ACTIVITY
1. "Make Technical Drawings"

Allow 5 class periods

OBJECTIVE: At the completion of this activity the student will have prepared a multi-view drawing (s) of his product design, as evidenced by the completed technical drawings.

EQUIPMENT AND SUPPLIES NEEDED: Drafting equipment, pencils, drawing vellum

REFERENCE MATERIAL: MECHANICAL DRAWING, French-Svensen, 7th edition, page 62 included
THE WORLD OF DRAFTING, Ross, pages 116-117, 123-125, 126-129. 136 not included
EXPLORING DRAFTING--basic fundamentals, Walker, pages 94-99 not included
DRAFTING TECHNOLOGY & PRACTICE, Spence, Bennett Pub. Co., Pages 49-75, 92-112, 283-305
BASIC INDUSTRIAL DRAFTING, Spence, Bennett Pub. Co., pages 28-59, 83-97, 113-135

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show how technical drawings describe the exact shape and size of a product designed.

   B. Discuss in detail each of the following topics:
      Shape description: See French-Svensen reference included

      Multi-view drawings: Pages 94 to 99 from text "Exploring Drafting--Basic fundamentals" by Walker.

      Conventional lines: Pages 116 & 117 of "The World of Drafting" by Ross.

      Dimensioning practices: Pages 123 to 125 of "The World of Drafting" by Ross.

      Labeling drawings: Pages 126 to 129 of "The World of Drafting" by Ross.

      Checking drawings: Page 136 of "The World of Drafting" by Ross.

2. Teacher demonstration: Explain to the students how to use and identify drafting equipment.

3. Student Activity
   With the aid of drafting equipment complete a multi-view working drawing of your designed product with complete dimensions, notes, and material list. Use check list to check drawing for errors or omissions of drafting practices.

MECHANICAL DRAWING, French and Svensen, page 60

5-1 Mental pictures and their description.

There are two things that a designer, inventor, or builder must be able to do: (1) He must be able to visualize or see clearly in his mind's eye what an object looks like without actually having the object, and (2) he must be able to describe it so that others could build it completely from the information given on his drawing. A few lines properly drawn on paper will describe an object more accurately and more clearly than a photograph or a written description. Line drawings must be used because photographs cannot be taken of an object yet to be built. These methods of using lines are based on principles known as the *theory of shape description.* The ability to describe the real shape of an object with lines, and to read and understand such descriptions, requires a thorough knowledge of these principles.

5-2 Describing objects by views.

For the graphical description of an object we should have available the paper, pencil, and instruments explained in Chap. 2. On the paper we can make measurements in a single plane only. All objects have dimensions that may be at angles or perpendicular to the paper as well as parallel to it. A picture could be made that would show, just as photograph would, the general appearance of the object, but it would not show the *exact* forms and relations of the parts of the object. It would show it as it *appears* and not as it really is.

Our problem then is to represent solid objects on a sheet of paper in such a manner as to tell the exact shape. This is done by drawing *views* of the object as seen from different positions and by arranging these views in a systematic manner.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

B. Technical Preparation

ACTIVITY
2. "Make Illustrated Drawings"

Allow 6 class periods

OBJECTIVE: *At the completion of this activity the student will have made an illustrated drawing of his product design, as evidenced by the presentation of the drawing to the instructor.*

EQUIPMENT AND SUPPLIES NEEDED: H pencil, drafting equipment, drawing vellum

REFERENCE MATERIAL: MECHANICAL DRAWING, French and Svensen, McGraw-Hill, pages 193-231 not included
DRAFTING TECHNOLOGY & PRACTICE, Spence, Bennett Pub. Co., pp. 226-248, 441-457, not included
BASIC INDUSTRIAL DRAFTING, Spence, Bennett Pub. Co., pp. 139-163, not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show that illustrations make a realistic representation of a product. They are used as descriptive aids for selling, maintenance manuals and for marketing the product.

   B. Refer to pages 193 to 231 of "Mechanical Drawing" by French

2. Teacher Demonstration
   Show how an isometric drawing is drawn.
   NOTE: Drawing should be as *dark* as possible for making a halftone photograph at a later date.

3. Student Activity
   With the aid of instruments and using multi-view drawing and model for reference, complete penciled isometric drawing of the product design and render it as necessary to make the drawing look as realistic as possible.

   Use an H pencil for final rendered drawing.

SECTION III. SYNTHESIS THROUGH PRODUCT DESIGN
B. Technical Preparation

ACTIVITY
3. "Writing Specifications"

Allow 2 class periods

OBJECTIVE: At the completion of this activity the student will have delineated and written detailed specifications on the product design as evidenced by the completed document.

EQUIPMENT AND SUPPLIES NEEDED: Pencil and paper

REFERENCE MATERIAL: Any instruction manual on writing specifications.

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show that products can be described in written form and are necessary to provide technical information relating to a product.

   B. The technical writer prepares instructional materials which accompany equipment purchases. His ability to understand and use scientific and technological information is necessary, because he takes this highly technical and scientific information and puts it in a common language that can be understood by the average individual.

   The type document that the technical writer prepares may appear in the form of:
   - Owners manuals
   - Instructional manuals
   - Operation manuals
   - Maintenance manuals
   - Assembly instructions
   - Service manuals
   - Technical reports
   - Specifications (construction details)

   The technical writer must also apply common sense and logic to relate the desired information to the reader. The information must be clear, concise, and give directions in logical sequence.

   Show example of an owner's manual.

2. Student activity
   A. With the use of the terms and information given, write a 3 page "manual" to accompany the completed product.

Suggested Terms to use for Manual

Technical	Descriptive
Process	Shape

ACTIVITY
"Writing Specifications"

Operation
Assembly
Parts
Disconnect
Accessories
Attachment
Dimension
Body
Base
Cylinder
Pen
Slide
Bolt
Nut
Screw
Washer

Procedure
List
Caution
Be careful
Attach
Locate
Quality
Precaution
Note
Insert
Slide
Fasten

Technical Writing Format

Cover:
- Company name
- Part name
- Part model

Body of manual:
- General introduction
- Detailed instructions on operation
- Service instructions
- Cleaning instructions
- Maintenance instructions
- Storage instructions

Back:
- Parts list
  - Reference number
  - Part number
  - Number of parts required

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

ACTIVITY
4. "Reproducing Prints"

B. Technical Preparation

Allow 1 class period

OBJECTIVE: At the completion of this activity the student will have reproduced his original drawings by at least two different methods as evidenced by the reproduced drawings and presented to the instructor.

EQUIPMENT AND SUPPLIES NEEDED: Heat & light sensitive materials for machines, blueprint, whiteprint machine (Diazo), Xerox machine

REFERENCE MATERIAL: TECHNICAL DRAWING, Giesecke/Mitchell/Spencer/Hill, 5th edition, pages 496-504 not inc. Use Keuffel and Esser transparencies #4-8, 4-9, 4-10, 4-11
DRAFTING TECHNOLOGY & PRACTICE, Spence, Bennett Pub. Co., pp. 746-755 not inc.
BASIC INDUSTRIAL DRAFTING, Spence, Bennett Pub. Co., pp. 212-214 not inc.

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show the methods of reproducing technical drawings so they may be distributed to manufacturing personnel.

   B. Review pages 496 to 504 from "Technical Drawing" by Giesecke et al.

2. Teacher Demonstration
   Show the students how to use machines for reproduction of prints.

3. Student Activity
   With the completed multi-view drawings and the technical illustration, reproduce four (4) copies of the drawings (2 white prints and 2 Xerox). Present one copy of each to the instructor; put one in your own file and file the originals for future use.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
1. "Compiling Information"

Allow 2 class periods 1 period for demonstration; 1 period for research in library or in radio or TV

OBJECTIVE: At the completion of this activity the student will have demonstrated an understanding of how to collect, select, and compile information and material, as evidenced by the information presented to the instructor.

EQUIPMENT AND SUPPLIES NEEDED: Access to resource center, pencil and paper, 4 x 5 cards

REFERENCE MATERIAL: WORLD OF MANUFACTURING, pages 48, 49, 50, 51 text book included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to provide the student a basic idea of information gathering for a live presentation about his product.

   B. Information to be presented to students:
      1. Resource material possibilities for information
         a. Newspaper
         b. Magazines
         c. TV Commericals
         d. Radio commericals
         e. Books on advertisment techniques and sayings

      Have students relate to concepts of advertising techniques and wording.
      Point out to the student current sayings that attract the public attention.
      Examples: "I can't believe I ate the whole thing."
      "You've come a long way baby."

      2. Note that resource material that relates to designed product should be recorded on 4x5 cards for future reference.

2. Teacher Demonstration
   A. Ways to demonstrate
      1. Transparences of advertisements from magazines or newspaper. (5 enclosed)
      2. Videotape commerical off of TV.
      3. Record commerical off radio.
      4. Check out book in library on advertising commericals if available.

      Explain how the advertisement could be related to a product.
      Discuss different moods, ideas, and sayings present in the advertisement.

3. Student Activity
   A. The student should compile 10 different 4x5 cards over the 5 different advertisement sources mentioned above that relate to his live presentation about his product.

ACTIVITY
"Compiling Information"

1. List on card the idea and saying that went with the idea.
2. List also any promises that were claimed in the advertisement.
3. Include how the advertisement was introduced.

B. These should be handed into instructor and checked.

WORLD OF MANUFACTURING, pages 48, 49, 50, 51

IDENTIFYING CONSUMER DEMANDS

You have read what our manufacturing system is like, how it is owned, how it is organized to work, and the importance of profit. The system produces goods or services for which there is consumer demand.

For the system to make a profit, there must be *output* as well as *input.* Output is the product or service to be sold by a manufacturer. *Consumers* are the people or companies that will buy it. Since there are many different consumers with many different demands, the manufacturer must decide what output he will offer. To do this, he must find out what the consumer will buy and at what price, whether there will be competition from other producers, and what this will mean.

In this reading, you will learn how manufacturers answer these questions about *consumer demand.*

Kinds of Consumers

Since a consumer is anyone who uses a product or service, all people are consumers. *Organizations* are also consumers. They buy raw materials, finished products, and special services in their own line of work. Organizations include:

1. manufacturers,
2. constructors,
3. retailers and wholesalers,
4. institutions (such as schools and hospitals), and
5. the government.

Consumer Demands

Consumers want or need various products and services. If you think about it, wanting and needing are not the same. For example, housewives may *want* a stove with a fancy control panel, an electric clock, and a glass door on the oven. They may actually *need* only a plain stove that cooks. There is demand for both plain and fancy stoves. Demands change. Consumers may decide that they want something today that they didn't want yesterday. This may happen because their standards of living change, or because a new kind of product is made. For example, years ago women were satisfied to wash the family clothes by scrubbing them with laundry soap. When automatic washers and synthetic detergents (man-made soaps) were introduced, women found out that there was a better way to do the wash. Permanent-press clothing has been developed because women want to cut down on their ironing. Contact lenses were made because people wanted their eyes to seem more natural. The desire for automobile safety has led to interior padding, tubeless tires, and safety belts.

Usually if new product prices are too high, most buyers will wait until prices go down. This is the case with color television sets.

WORLD OF MANUFACTURING, pages 48, 49, 50, 51

Seven Important Demand Questions

Suppose that a manufacturer can develop enough manpower, equipment, raw materials, and know-how to manufacture a new product. He needs to know whether there is a demand for this product. If there is, he needs to know what the demands will be. To find out, the manufacturer asks these questions:

1. *What is the potential (possible) market for my product?* How many buyers will want or need the kind of product I offer?
2. *Who makes up this market?* Will the demand come from all kinds of people and organizations or from certain groups?
3. *What is the trend (direction) in sales for this market?* Is the market growing from year to year? Is it about the same from year to year, or is it declining?
4. *Will at least some buyers prefer my product to others they can buy?* Is the performance, packaging, and price of the product good enough to compete with other products?
5. *How will competition affect my product?* Will competition take away my business or increase the demand for my product?
6. *If there is competition, how many sales can I expect?* If I make widgets, will I sell 50% of all widgets bought or only 5%?
7. *Based on the share of market (sales) I expect, will the number of products sold be large enough to give me a profit?* Will probable sales pay me back for the money I've put into buildings and equipment? Will it also cover production and operating costs, leaving me something extra for profit?

If the answers to any of these questions are unsatisfactory, the manufacturer must consider redesigning his product or changing his plans to *market* (sell) it.

Obtaining Consumer Demand Information

Before marketing a product, a manufacturer can *research a market* (get facts to find out possible sales). After the product is placed for sale, close watch can be kept on the market to see how much buying and selling is being done. A manufacturer may *consult* (check) *available market data* (information already on hand), or he may do his own *specialized consumer research.* In the case of low-cost goods that can be made in large numbers, the manufacturer may make a small number of products and let people actually test them. For high-cost, long-lasting goods, he may use information already on hand for similar goods.

WORLD OF MANUFACTURING, pages 48, 49, 50, 51
(c) McKnight Publishing Co., Bloomington, Ill.

Available market data are of two kinds: (1) *surveys* made by government or by private firms, such as U.S. Census or magazine surveys of special markets (for example, "What Are Teenagers Buying Today?"), or published studies of sales; and (2) *market performance data* (sales information) usually bought from research firms. For instance, the A.C. Nielsen Co. reports the monthly or bimonthly sales figures on leading brands of products for all areas of the country. After sales have started, a manufacturer can check his own sales and shipment figures.

Specialized consumer research includes these studies:

1. *Usage and attitude research*--asking questions through interviews and questionnaires about consumer buying habits, buyers' attitudes toward current products, and their desires for product improvements;

2. *Product research*--gathering consumer opinions on product performance, package designs, brand names, and product appearance; and

3. *Advertising and promotion research*--checking how many consumers are likely to remember a television commercial or an advertising slogan, or to be attracted to a store display.

Studies can be made to find out consumer response to everything from a price change to a coupon mailing. Usually, the producer can do research in his own market research department, or have it done by an advertising agency or private market research firm.

Marketing the Product

When a producer knows he can make a product and that there is a demand for it, he draws up a *marketing plan* that shows how the product will be sold. The plan uses the information and *strategy* (plan of action) for sales, promotion, and advertising. The plan shows:

1. Purpose or purposes for which the product is to be sold.

2. Sources from which sales are expected.

3. Kinds of people who will buy the product.

4. How they buy and how often.

5. Price and Value information.

6. *Product performance* (how well it works) and advantages to be pointed out in advertising.

7. Kind of advertising (newspapers, radio, TV).

8. Ways of *distribution* (ways of getting the product to the buyer).

WORLD OF MANUFACTURING, pages 48, 49, 50, 51

Distribution can be through a wholesaler or a retailer, or the product can be sold directly to the customer. For production purposes, the manufacturer will also make a *sales forecast* (estimating sales from month to month and area to area).

When a product is being sold, the producer must decide how to make his product *more* acceptable to consumers. This can be done by improving the product, lowering the cost, and providing better service. The producer who does not do these things will find his sales falling as competitors improve *their* products.

A lot of time can pass between finding out buyers' wants and marketing the product. Sometimes ten years or more may pass. In other cases, products are put on the market in just a few months.

Summary

We have seen that consumers are people or companies that use products and services. Consumer demand is based on the needs and wants of a consumer group. As living standards change or as new products are made, wants and needs also change. Before a producer decides to make a product, he must make sure that there is a demand for it. He must find out the probable size and the condition of his market. He must figure out how many buyers will want his product. He must decide if the likely number of sales will give him a profit after costs are paid. To answer these questions, the producer can use market information on hand or he can do his own research. When he thinks his product can be sold for a profit, he makes up a marketing plan showing the information and strategy needed to sell his product.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
Ib "Outline Information"

Allow 2 class periods

OBJECTIVE: At the completion of this activity the student will understand how to outline resource material, as evidenced by the outline presented to the instructor.

EQUIPMENT AND SUPPLIES NEEDED: Pencil and paper

REFERENCE MATERIAL:

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show the student how to arrange collected resource material.

   B. Information to present to students:
      1. How outline is composed.
         a. Introduction: Something to grab the audiences attention. If you don't get their attention in the first two sentences you have lost them for the entire presentation.

            May do it by asking a question of interest to the consumer. Surprise the consumer.

         b. Statement that wins interest

         c. Provide answer for aroused interest with information about the product.

         d. Interlock idea with product for identification. Example: "I'd walk a mile for a Camel" Idea-walk a mile Product-Camel Interlock identification with both sight and sound for impact.

      2. Know consumers
         a. To communicate any idea you must know your consumer, and you must use words and pictures they will understand.

         b. Since a consumer is anyone who uses a product or service all people are consumers of some kind. You have to determine what consumers buy your type of product.

         c. The writer must understand the consumer or the consumer will not understand the message. The writers taste is no criterion. He must know how his consumer lives and what he experiences, to bridge the gap of communication.

ACTIVITY
"Outline Information"

3. Advertising's needs
   a. Good advertising should be simply human and persuasive.

   b. Simple, easy to understand words make it easy to believe, hard to forget.

   c. Advertising needs the persuasive power to do a selling job.

4. Do's and Don'ts of Good Commerical writing.
   a. Don't start without complete preparation.
      1. Learn your product
      2. Learn your market
      3. Learn your viewer

   b. Don't jump right into sales pitch.
      1. Win consumers interest in first few seconds.
      2. Get consumers eyes and ears and mind on your message.

   c. Don't confuse with too many sales points.
      Stay on 1 central idea, build it up logically.

   d. Don't talk too long.
      Keep within consumers understanding limits.

   e. Don't cut talk to short.

   f. Don't play tricks on audience.
      1. Be honest in winning interest.
      2. Keep it relevant.

C. Teacher may provide example of an outline on chalk board.

2. Student Activity
   From resource material compose outline as explained in the above presentation.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
Ic "Selecting Necessary Visual Material Aids"

Allow 2 class periods

OBJECTIVE: At the completion of this activity the student will know how materials are selected and used in reinforcing live presentations as evidence by the visual material aids selected.

EQUIPMENT AND SUPPLIES NEEDED: Xerox, thermofax, projectors, poster board, etc. (Depending upon student's selection)

REFERENCE MATERIAL:

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose for this activity is to give the student knowledge of how visual aids are selected and used in reinforcing live presentations.

   B. Information to be presented to student.
   Methods of visually communicating a product to an audience.

      1. Present your product will all its visual worth (product is a necessary visual material aid)
         a. Good lighting can give unspoken impact to your product.

      2. Posters made by student over advertisment.
         a. Make posters realistic to a situation where product is being used.
         b. Don't make wild claims on poster that the product won't do.
         c. Make poster believable.

      3. Pictures taken of a product similar to or just like yours.
         a. Blow up picture to 8x10 for presentation purposes.
         b. May pass aournd class as giving presentation.

      4. Transparances on overhead.
         a. Make transparances of an advertisment.

      5. Slides.
         a. Student can make slides to be shown during presentation.

   NOTE: The teacher should demonstrate with visual aids when he gives example advertisements. Don't expect the students to do something you won't do yourself.

2. Student Activity
   A. Students will make a list of visual material aids that they plan to use.

   B. Student will list how he intends to make the best use of these visual material aids selected.

   C. Student will prepare the necessary visual material aids for his/her presentation.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
Id "Present Information"

Allow 3 class periods

OBJECTIVE: At the completion of this activity the student will have presented information that has been compiled and selected as evidenced by the presentation to an audience.

EQUIPMENT AND SUPPLIES NEEDED: Equipment will vary with each student-depending on material selected to give presentation.

REFERENCE MATERIAL: "How to Prepare a Speech", pages 56-59 included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to allow the student to give a live presentation of his complied commerical.

   B. Key points to be presented
      1. Practice alone at first.
      2. Practice before a listener.
      3. Be well dressed on the day you give advertisement
      4. Acknowledge your introduction
      5. Take deep breath before beginning
      6. Make no apologies for your presentation
      7. Always face your audience when possible
      8. Talk slowly and distinclty
      9. Avoid deadly monotone
      10. Throw yourself into the subject

   C. Teacher may demonstrate activity if necessary (Give a commerical yourself to show them how it should be done.)

   D. The student's speech should be evaluated more on ideas and content than on how well he presented it.

2. Student Acitivities
   A. From outline compiled and with material needed, the student should present his advertisement to the class.

FROM: How to Prepare a Speech, copyright McGraw-Hill Book Co., New York, N.Y.

POINTERS TO MAKE THE PRESENTATION LESS DIFFICULT

Here are a few pointers, which, although likely to be overlooked by the beginner, mark the difference between a successful and unsuccessful attempt to present the ideas on which one has labored so long.

PRACTICE AT FIRST ALONE

It is important that you read the final copy of your presentation aloud a number of times so as to feel familiar, not only with its phraseology, but also with the sound of your own voice.

Begin your practice in a room by yourself, and with the door closed. It should be a room equipped with a full-length mirror. Standing in front of the mirror, borrow something from the professional golfer--adopt a stance. Yet it must be a relaxed one. To accomplish this, keep your feet close together, with one foot slightly ahead of the other, and your weight on the front foot as you read aloud, look occasionally into the mirror.

At first you will be stilted, but if you relax you will soon be at ease with your phantom audience. Practice swinging your gaze from right, to center, to left, and back again. Thus you will avoid staring at the floor or ceiling. Your mirror will also disclose any mannerisms which you should eliminate.

PRACTICE BEFORE A SYMPATHETIC LISTENER

If, from your mirror, you can graduate to speaking before a sympathetic listener it will be helpful. This time practice in the largest room in your home, directing your words to this person seated in the furthest corner. In this manner you will increase your chances of being heard at the club. This does not mean that you need to shout, but it will train you to make your voice carry.

Watch your tempo. It should be neither unduly slow nor nervously fast. If your listener will do some inconspicous timing the tempo can be better regulated.

ON THE DAY YOU PRESENT YOUR SPEECH. GIVE HEED TO THE WAY YOU DRESS

Don't wear a new dress, but one that you enjoy wearing. This will make for ease and comfort. Avoid shoes that pinch, or gloves that stop circulation. Shun the collar that is tight. These all can result in annoyances which will affect your delivery.

ACKNOWLEDGE YOUR INTRODUCTION

There is more than courtesy involved here. This little amenity gives you time to assume a natural, easy position and also gives the audience an opportunity to look you over and then settle down to the business at hand.

TAKE A DEEP BREATH BEFORE BEGINNING TO READ

This has a relaxing effect and gives you the impe to begin reading in a good strong voice.

MAKE NO APOLOGIES FOR YOUR PRESENTATION

There is no place for apologies either at the beginning or at the end of your presentation. Any apologies which you make concerning subject matter, style, or lack of preparation can only detract from your presentation.

ALWAYS FACE YOUR AUDIENCE

Look at, and speak to, your audience. If you have conscientiously prepared you will be so familiar with your presentation as to be able to look up from time to time without fear of losing your place. Points you wish to emphasize, anecdotes you relate, should be done "face to face." In this way you will give your hearers the impression that you are interested in them, and would like them to be interested in what you say. This will enable you to present your ideas more effectively.

TALK SLOWLY AND DISTINCTLY

Don't rush your speaking. There is no reason to hurry. Don't give the impression that you have just so much to cover and the faster you go, the sooner you will be finished.

BE CAREFUL TO AVOID THE DEADLY MONOTONE

Change your tone from time to time depending upon the emphasis which you want to place. This natural change in tone will eliminate any danger of "elocuting." Remember that it is better to use more volume than you need, rather than not enough.

THROW YOURSELF INTO YOUR SUBJECT

Show an interest by a genuine display of feeling, and an emphasis upon convictions. In other words, "go wrapped up in your subject." A speaker interested in your subject arouses a contagious interest that counteracts many speaking faults. Furthermore, losing yourself in your subject is the very best antidote for nervousness. You have something you want to give to people; don't just offer it tentatively or nervously, but let your own conviction of your value shine through.

Finally, remember that after these weeks of preparation you know more about the subject than the members of your audience do.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
le "Survey of Advertisements Presented"

Allow class periods

OBJECTIVE: At the completion of this activity the student will have evaluated the results of his presentation as evidenced by the completed survey instrument presented to the instructor.

EQUIPMENT AND SUPPLIES NEEDED: Survey Instrument

REFERENCE MATERIAL: "Delphi Technique of Research" included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to give the students the basic idea of surveys and how information is gathered. Reliability of information obtained should also be made aware to the students.

   B. Key Points to be presented
      1. Present information about the Delphi Survey Technique.
         a. Get first ten (10) reactions of students.
         b. Ask students to rank in order the findings of first survey.
         c. Then rank in respect to their importance of ranking.

   C. Teacher may demonstrate activity if necessary.

2. Teacher Activity to be completed after students have made presentation about their designed product.
   A. Present correspondence sheet No. 1
      1. Students fill out sheet No. 1
      2. Combine the duplicate statements and make a list of all products stated.

   B. Present correspondence sheet No. 2
      1. Have students fill out sheet No. 2
      2. Rank in order, according to group average the highest ranked to the lowest ranked

   C. Present the class with results listed in rank order of group average.

DELPHI TECHNIQUE OF SURVEYING

The Delphi Technique involves getting individual's reaction to specific questions or statements; combining these reactions and again asking these individuals to review and rank the findings until a priority ranking has been established. This technique produces individual and group ideas which the Surveyer may use in the most appropriate manner.

From Delphi: "A Planning Tool"

By: Charles O. Hopkins
Kenneth L. Ritter
William W. Stevenson

CORRESPONDENCE SHEET NO. 1

Please list ten (10) possible endings, no particular order of importance required, to the following statement.

After listening and considering all commercials presented I would be most willing to buy the following products . . . .

List your answers below:

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

CORRESPONDENCE SHEET NO. 2

Below are the combined factors that you and others suggested that you were most willing to buy. In order that a priority can be established on most essential factors to be analyzed, we are asking you to rank each factor on an 11-point scale, ranging from most important (1) to least important (11).

Please be selective in choosing those factors you consider as most important for analysis.

Example:

	Place X in appropriate section	
	Most willing to buy	Least willing to buy
1. John Doe—Real Estate commercial	1 2 3 4 5 6 7 8 9 10 11	
2. Jane Smith—Charcoal tongs commercial	1 2 3 4 5 6 7 8 9 10 11	

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
2a. "Psychology of Commercials"

Allow 1 class period

OBJECTIVE: At the completion of this activity the student will have an understanding of the methods used to influence an audience in advertising as evidenced by research materials.

EQUIPMENT AND SUPPLIES NEEDED:

REFERENCE MATERIAL:

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to provide the students with a better understanding of the effect and influence TV commercials have on the audience.

   B. Key Points to be presented
      1. TV commercial costs
         a. Average of $25,000 for 60 second time spot on daytime TV.
         b. Average of $69,000 for a 60 second time slot on nightime TV.
         c. Some companies spend as high as 3.5 million for expenses of filming and buying a prime spot on night time TV.

      2. Almost all commercials are tested by showing them to a group of people before being televised.
         Purpose of the tests are:
            1. To get the response of the poeple
            2. To see if it is worth televising

      3. It is against the law to flash a 1/10 second film of product on the TV.
         a. People register this in their subconscience and buy product but without realizing why
         b. Outlawed this because it is classified as a form of hypnosis.

      4. Federal Communications Commision (FCC) controls all advertisements.
         a. Fraud is also against the law.
            1. Saying the product will do something it won't
            2. Misrepresentation of product
         b. Falsifing original prices on a product is illegal
            Example: 1. Original price is $52.00 of a product (Company says original price is $82.00 and is now selling at $52.00.)
                     2. Original price has to be a price that the Company can prove it once sold at.

2. Teacher may provide examples of advertisements and discuss.

3. Student Activity
   Activity No. 1

ACTIVITY
"Psychology of Commercials"

A. Select two (2) advertisements that may have misrepresented a product. Present to class.

B. Have student present commercial to class.

Activity No. 2

A. Assign students to estimate the cost a company spends in advertisement in one night.
   1. Have students select a product at random on TV.
   2. Count the seconds the commercial is on the air.
   3. Count the number of times the commercial is shown on a program in a night.

B. These should be handed into the instructor and checked.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
2b. "Compiling Information"

Allow 2 class periods

OBJECTIVE: *As a result of this activity the student will know how to collect, select, and compile material related to his commercial, as evidence by the compiled information presented to the instructor.*

EQUIPMENT AND SUPPLIES NEEDED: Access to resource center, pencil, 4x5 cards

REFERENCE MATERIAL: WORLD OF MANUFACTURING, texts, pages 4, 9, 50, 51
(pages 50, 51 are referenced under previous Compile Information)

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to give the student a basic knowledge of how to gather information to write a script for advertisment of a product.

   B. Compile resource material that relates to your product on 4x5 cards for future reference.

2. Teacher Demonstration
   A. Teacher should demonstrate on a TV monitor or tape recorder several commercials as copied from a TV or radio program.
      1. Discuss good and bad points in commercial. Students should be able to pick up poor taste and poor effects of commercials.
      2. Tape ahead of time if possible so you don't have to wait on a commercial to come up.

3. Student Activity
   A. The student should compile 10 different 4x5 cards over 5 different advertisement sources that relate to his TV or radio commercial of his product.
      1. List on card the idea and the saying that went with the idea.
      2. List promises claimed in advertisement.
      3. How the advertisement was introduced.
      4. Multiply the two together and come out with total seconds of time bought on TV.
      5. Multiply each 60 second by $69,000 to get total amount the company spent.
      6. Write these figures and company on a card and turn in to instructor.

WORLD OF MANUFACTURING, pages 4, 9

Crafts

With more free time, man began to develop *crafts* (special skills).

1. He learned how to make clay containers to hold water.
2. He learned how to build sturdy shelters of clay, stone, or wood.
3. He devised ways of weaving pieces of vine and grass together to make baskets.
4. Sleds helped him to carry his goods more easily and quickly than he could have carried them on his back.
5. After a long time, he invented a loom for weaving fiber into cloth.

All these inventions and others helped man to move about and look for new homes. He was able to live in regions that were too cold or too dangerous for primitive man. Also, with more food many people could live as a group. In several parts of the world a *society* (a permanent group of people forming a single community) started to develop.

Page 9 The Evoloution of Manufacturing

Industry is the making of products by constructing and manufacturing. *Constructing* is the making of fixed products on a site. *Manufacturing* is the making of movable products which often are used some distance from where they are manufactured. Together, construction and manufacture provide modern man's food, clothing, and shelter. They extend his ability to travel and to speak or communicate. Manufacturing is the subject of this textbook.

Primitive Manufacturing

Early man chipped pieces of stone into weapons to defend himself and to hunt animals for food. He learned that he could use animal skins for clothing. He then began to weave dried grasses, twigs, and leaves into baskets, and to *shape* (form) clay and mud into pots.

Although man provided himself with many simple conveniences, it took a very long time to produce just enough for his own family. There was no money to exchange for goods and no way to move goods from place to place. Sometimes man did exchange or *barter* (swap) his goods for other products, but for thousands of years most men produced only enough for their own families' use. This system of production is called the *household system.*

As men grew more skillful in making and using simple tools, they explored more of the earth. Groups of people scattered across the lands we now call Africa, Asia, and Europe. Later they reached the Americas and Australia. Each group of people made things from the *materials of nature* that were easy to get. For example, Eskimos built small boats covered with animal skins. Indians of the North American forests built birchbark canoes. In other lands, people built boats from reeds or hollow logs.

In different lands people invented more than one way to make the same kinds of things. Where there was clay, people shaped it into pots and dishes. In some places man found *metal ores* and discovered that they could hammer the metal into different shapes. Using wool from sheep, goats, llamas, or camels, they *devised* (invented) ways to spin yarn and weave cloth. They devised various kinds of containers to hold water or oil. They made ornaments to wear, like beads, rings, or headbands. They drew pictures and carved figures. They built rafts or boats and made all sorts of sails, oars, and towropes for moving them.

Many ideas were probably used more than once. For instance, who first thought of holding together two pieces of animal skin by lacing a leather strip through small holes? Did this idea spread as man traveled? Was it invented several times in several places? We do not know. Men used such ideas for thousands of years before they invented writing.

Many skills used to make one product were later used to make something quite different. For example, as men became skilled in *firing* (baking) pottery, they learned much about controlling heat. This knowledge was used later when they devised the skill called *smelting* (heating ores until the metal melts and runs together). All of these skills developed at different times and in different places.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

C. Presented Media

ACTIVITY
2c. "Outline Information"

Allow class periods

OBJECTIVE: At the completion of the activity the student will understand how to outline resource material as evidenced by the outline presented to the instructor.

EQUIPMENT AND SUPPLIES NEEDED: Pencil and paper

REFERENCE MATERIAL: THE TELEVISION COMMERCIAL, pages 149-150-151 not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to give the student an idea of how to compose and arrange collected material.

   B. Key Points to be presented
      1. How outline is composed.
         a. Introduction: Something to grab the audience's attention. If you don't get their attention in the first two sentences you may have lost them for the entire presentation.
            1. May get attention by asking a question of interest to the consumer.
            2. Surprise the consumer.

         b. Statement that wins interest
         c. Answer that interest with information about product.
         d. Interlock idea with product for identification. Example: "I'd walk a mile for a Camel." Idea-walk a mile Product-Camel
         e. Interlock identification with both sight and sound for impact.

      2. Know consumers
         a. To communicate any idea you must know your consumer and you must use words and pictures they will understand.
         b. Since a consumer is anyone who uses a product or service all people are consumers of some kind. You have to determine what consumers purchase your type of product the most.
         c. The writer must understand the consumer or the consumer will not understand the message. The writers taste is no criterion. He must know how his consumer lives and what he experiences in order to communicate.

      3. Advertising's needs
         a. Good advertising should be simple, human, and persuasive.
         b. Simple, easy to understand words make it easy to believe, hard to forget.
         c. Advertising needs the persuasive power to do a selling job.

4. Do's and Don'ts of good commercial writing.
   a. Don't start without complete preparation.
      1. Learn your product
      2. Learn your market
      3. Learn your viewer
   b. Don't jump right into sales pitch.
      1. Win consumer's interest in first few seconds
      2. Get consumers eyes and ears and mind on your message
   c. Don't confuse with too many sales points.
      1. Stay on one central idea, build it up logically
   d. Don't talk to long.
      1. Keep within consumer understanding limits
   e. Don't cut talk to short.
   f. Don't play tricks on audience
   g. Be honest in winning interest
   h. Keep it relevant

2. Teacher may demonstrate by showing a prepared outline.

3. Student Activity
   A. From resource material compose an outline as explained.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
2d. "Writing Video and Audio Scripts"

Allow 3 class periods

OBJECTIVE: At the completion of this activity the student will have an understanding of how to write and develop video and audio scripts as evidenced by the completed script.

EQUIPMENT AND SUPPLIES NEEDED: Script paper and pencil

REFERENCE MATERIAL: "Zettl Televison Production Handbook" pages 443, The Television Commercial not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to give the student an idea of how scripts are written.

   B. Key Points to be presented
      1. Preparation of Shooting Script
         a. Two elements of script.
            Video--Instructions on sequence and nature (subject) of each "shot".
            Audio
            (1) Complete verbal script as you wish it heard (to be used by talent only)
            (2) Actual script the cameraman or director uses. Needs (or should) to contain sufficient "cue" words to identify each shot and sequence of shots.

         b. Physical Construction of Script
            Usually two columns: e.g. left gives camera instruction; right gives audio cues to director and cameraman.

            Terminology:
            C.U.--Close up
            W.S.--Wide shot
            M.S.--Medium shot
            Zoom--Transition shot to be used only when necessary to maintain continuity. e.g. If final product will be assemble-edited, zoom not needed if audio is carefully planned.
            Pan--lateral rotation of camera on tripod e.g. tripod stationary; camera swings (pans) left or right across the scene.
            Tilt--Vertical motion of camera on tripod; e.g. tripod stationary; camera tilts up/down.
            Dolly--If tripod is equipped with casters, then it can be moved (dollied) in or out to compose shot.
            Truck--If camera and tripod are equipped with casters, then it can be moved(trucked) left or right to compose shot.

c. Editing to produce finished tape.
Whereas Sony ½" best lend themselves to continuous non-edited production, some necessary editing can be done by "assembling" selected scenes and shots in consecutive (sequential) order. e.g. "Insertion" editing--where a shot is inserted per se in an existing sequence is usually not successful. Stability and video information is lost. This means shot production needs to be carefully planned so that assemble-editing will suffice. . The less editing--the better!

d. Graphics
Aspect ratio of 3 to 4 must be maintained: e.g. 3 units high by 4 units wide.
Black lettering on light grey or blue background.
Maintain sufficient margin so camera error is covered.
Lettering size: Example:
Overall card size 11" x 14" will require letter size approximately ¾" height. Lines should be double width.
Information on individual graphic should be kept to minimum.
With one camera operation, two alternatives are possible:
(1) most desireable method is to "assemble-edit" the tape by shooting scenes and graphics in proper order. This will require careful planning with respect to audio so that a smooth transition from scene-to graphics-to scene takes place.
(2) tape-to-tape graphic insertion will result in loss of information and stability.

e. Open interest to viewer
Any survey of the effectiveness of a television commercial that fails to consider opening viewer interest, does not do a complete job. Whether you use cartoon, live action or other technique at the start does not matter, as long as you do win interest and attention.

The opening must be relevant, of course. It must relate to the product story you are to tell and it must relate to the viewer, personally.

The first five seconds often are the most vital because here your audience is won or lost. Viewers can leave the television room or they may mentally turn off the set and turn on the conversation.

Cartoon is ideal for opening interest, because it says "fun"! to the viewer. In live action, a personality, babies, or family life can excite interest. In stop motion, commercials such as the Scotch Tape march and the Pillsbury floating pancakes have quick fascination.

f. Do's and Don'ts of Good TV Commercial Writing
The most common mistakes in writing for television commercials would be found somewhere in these twelve Don'ts. As antidotes, a dozen Do's follow:

1. Don't start without complete preparation. Do learn your product, your market, your viewer.
2. Don't jump right into a sales pitch. Do win viewer interest in the first few seconds. Get his eyes and ears--and mind--on your message.
3. Don't confuse with too many sales points. Do stay with one central idea, build it up logically.
4. Don't write too much audio. Do keep within the speed of viewer understanding. For most purposes: 130-155 words per minute.
5. Don't write too little audio. Do keep interest sustained, once you have won it. Work for combined sight-sound impact.
6. Don't cut scenes too short. Do set a minimum of 3 seconds for the viewer to fully orient himself to any new scene.
7. Don't run scenes too long. Do use the rule-of-thumb, that, after 6 seconds, "something better move--or the viewer will."
8. Don't write exclusively for the eye; the viewer can't come back and look at it, as in a magazine. Do write for complete understanding; the audio should make clear what the video does not quickly explain.
9. Don't play tricks on your audience. Do be honest in winning interest--keep it relevant--and by honest in demonstration and use of so-called "camera tricks."
10. Don't confuse with too many scenes, or "too busy" scenes. Do keep all settings simple, without distractions from your sales story.
11. Don't use too many actors. Do keep basic casts small. One or two persons can ingratiate themselves to the audience faster, more personally, than a group. Also, remember the SAG talent re-payments.
12. Don't skimp on video instructions. Do describe each scene fully and completely. If necessary, write a third column to explain your objectives and how you believe each scene should be handled.

g. The Writer's Six-I-checks of a Commercial:

There are six needs of a television commercial which "I" must check. The first two factors have to do with planning.; the second two are the factors that gain an audience; the last two factors that sell the audience. Remember it this way:

IN PLANNING:

I need first the sales *idea*--
Then I need to develop this *idea* with *imagination*

ACTIVITY
"Writing Video and Audio Scripts"

IN GAINING VIEWERS:

I need first to win the viewer's *interest*--
Then I need to answer that *interest* with *information.*

IN SELLING VIEWERS:

I need first to interlock the *idea* with the product for *identification*--
Then I need this *identification* interlocked with both sight and sound for *impact!*

Check and re-check! Yes, the most successful commercials are able to pass these six I-checks before they reach the screen:

IDEA AND IMAGINATION
INTEREST AND INFORMATION
IDENTIFICATION AND IMPACT

h. Random observations

About BELIEVABILITY: Psychologically, we know it is necessary to establish one believable scene before the viewer is ready to believe subsequent claims. Perhaps Alka-Seltzer has done this job better than anyone else. They say: "Drop a tablet in the water--listen to it FIZZ! Drink it--you'll feel better."

When a customer drops an Alka-Seltzer in the water, it does FIZZ. He believes it. Then he drinks it--and feels better! Psychology at work, both in advertising and in actual practice.

About CASTING: TV commercials should receive casting that is different from motion pictures or even TV entertainment films. There is greater need for not-too-handsome faces with "character" that quickly win viewers. There is less need for the too-pretty girl. In a magazine ad, the reader can casually change his interest from the pretty girl to the copy--but in television he simply doesn't have time to shift gears.

2. Teacher may hand out sample copies of a script.

3. Student Activity
   A. Student is to prepare his/her script from outline and information given.
      1. Need first to have an idea
      2. Need to develop idea with imagination
      3. Need to win viewers interest
         If interest not meet in first five seconds, he will be in getting a sandwich from the refrigerator
      4. Answer interest with information
      5. Interlock idea with the product for identification
      6. Need this identification interlocked with both sight and sound for impact.

A. Preparation of Shooting Script
   1. Two elements to script.
      a. Video--Instructions on sequence and nature (subject) of each "shot".
      b. Audio
         (1) Complete verbal script as you wish it heard
         (2) Actual script the cameraman or director uses need (or should) only contain sufficient "cue" words to identify each shot and sequence of shots. (See sample included)

   2. Physical Construction of Script
      a. Usually two columns: e.g. left gives camera instruction; right gives audio cues to director and cameraman.
      b. Terminology:
         C.U.--Close up
         W.S.--Wide shot
         M.S.--Medium shot
         Zoom--Transition shot to be used only when necessary to maintain continuity. e.g. If final product will be assemble-edited, zoom not needed if audio is carefully planned.
         Pan--Lateral rotation of camera on tripod e.g. tripod stationary; camera swings (pans) left or right across the scene.
         Tilt--Vertical motion of camera on tripod; e.g. tripod stationary; camera tilts up/down.
         Dolly--If tripod is equipped with casters, then it can be moved (dollied) in or out to compose shot.
         Truck--If camera and tripod are equipped with casters, then it can be moved (trucked) left or right to compose shot.

   3. Editing to Produce Finished Tape.
      Whereas Sony ½" best lend themselves to continous non-edited production, some necessary editing can be done by "assembling" selected scenes and shots in consecutive (sequential) order. e.g. "Insertion" editing--where a shot is inserted per se in an existing sequence is usually not successful. Stability and video information is lost. This means shot production needs to be carefully planned so that assemble-editing will suffice. The less editing--the better!

   4. Graphics
      a. Aspect ratio of 3 to 4 must be maintained: e.g. 3 units high by 4 units wide.
      b. Black lettering on light grey or blue background.
      c. Maintain sufficient margin so camera error is covered.
      d. Lettering size: Example:
         Overall card size 11" x 14" will require letter size approximately ¾" height. Lines should be double width.
      e. Information on individual graphic should be kept to minimum.
      f. With one camera operation, two alternatives are possible:
         (1) most desireable method is to "assemble-edit" the tape by shooting scenes and graphics in proper order. This will require careful planning with respect to audio so that a smooth transition from scene-to-graphics-to-scene takes place.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

C. Presented Media

ACTIVITY
2e. "Staging the Commercial"

Allow 2 class periods

OBJECTIVE: At the completion of this unit the student will understand the method and techniques of staging a commerical as evidenced by the completed production in the next activity.

EQUIPMENT AND SUPPLIES NEEDED: Necessary staging equipment (depending upon student advertisement)

REFERENCE MATERIAL: "Zettl Television Production Handbook", not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to introduce the fundimentals of Stagecraft to the student so he can apply it to his commercial.

   B. Key Points to be presented to the student
      1. Television scenery and propertees
      2. Graphics to be used on television
      3. Performing and acting
      4. Station personnel
      5. Make-up and clothing

2. Teacher may demonstrate types of staging and preparation for filming.

3. Student Activity
   A. Student to prepare supplies needed to stage his/her commercial.

   B. Student should make all Graphics necessary to produce commercial.
      1. Title card (3 to 4 ratio)
      2. Cue cards for actors (if any)

   C. After Graphics and Props are completed the student should "Produce the Commercial"-- see following activity sheet.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

C. Presented Media

ACTIVITY
2f. "Producing Commercial"

Allow 5 class periods

OBJECTIVE: At the completion of this activity the student will know the procedures of producing the commercial, as evidenced by the commercial presentation.

EQUIPMENT AND SUPPLIES NEEDED: Video tape equipment or tape recorder

REFERENCE MATERIAL: "Zettl Television Production Handbook" not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to give the student the procedures and techniques of producing a commercial.

   B. Information to be presented
      1. The Video camera
      2. Lenses of the camera
      3. Audio and recording on camera
      4. Lighting
      5. Special effects
      6. Film and video tape recording
      7. The television studio and control centers
      8. Producing and directing

2. Teacher should demonstrate proper handling of the equipment.

3. Student Activity
   A. Students are to produce and direct commercials. (Either with tape recorder or video tape recorder.)
      1. Set up staging and lighting
      2. Film title card
      3. Film commercial script
      4. Edit if needed

FOR EFFECTIVE COMMERCIALS–LIVE AND TAPE

DO	DON'T
In copy, speak the viewer's own language.	Don't talk too much and especially don't talk "advertisingese."
Concentrate on the picture side first & add the audio copy later.	Don't develop the words first. . . this is radio and print technique.
Use interesting staging, appropriate props and keep the pictures moving or changing with motivation.	Don't rely on announcer's sheer personal magnetism to hold audience even for one 60-second commercial.
Run through the pictures without the sound. Make the visual side tell a complete story. Strive for unusual and memorable graphics at all times.	Don't rely on the combination of radio-style copy and whatever pictorial sequences are at hand and easiest to use.
Try to involve viewers emotionally.	Don't create unrealistic situations and hope to convince.
Make the pictures tell the dominant portion of the story.	Don't write too much audio copy.
Use optical and electronic effects where possible in the tape commercial. Make it creatively interesting and technically right for production.	Don't write a "live commercial" and simply record it on tape.
Stress close-ups to make your message personal, vivid and more effective.	Don't wait more than a few establishing seconds before coming in close.
Identify in many ways–background sign--or foreground sign--reveals--and supers with or without prices.	Don't rely on sponsor identification only at open and close.
Use situations, questions, dramatic statements by people, cartoons, etc.	Don't use printed headlines to arrest attention.
Keep the progression of ideas, pictures and sales points moving to your objective.	Don't use an unrelated opening or "stopper" merely to get attention.
Strive for extremely clear visuals.	Avoid cluttered backgrounds in pictures.

DO	DON'T
Create mood and effect lighting to enhance the commercial.	Don't rely on flat lighting.
Let the camera show and demonstrate products.	Don't merely mention their benefits.
Prove selling features as you would in person.	Don't just point to the product and talk selling features.
Feature one major theme or item in a commercial.	Don't use television to list items as you do newspapers.
Create an interesting "intro" on film or tape with your own music theme.	Don't keep changing the opening of your commercial.

SAMPLE SCRIPT

Program THE USE OF THE DRILL PRESS Instructor _____

Producer _____ Director _____

Date _____ Time _____ Length _____

	Video		Audio
Shot #	Type	Composition	
1	W.S.	Pan across complete set showing talent and equipment to be used	This lesson #6 in this series Now let's take a look at the chuck
2	C.U.	Close shot of a chuck	The chuck Now let's look at its relationship to the rest of the machine.
3	M.S.	Entire drill press and instructor's hands	This particular chuck The table adjustable.
4	C.U.	Zoom in on Drill-Press Table	The table

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
3a. "Compiling Information"

Allow 2 class periods

OBJECTIVE: Upon completion of the activity on compiling information the student will have a knowledge and understanding of how to collect, select and outline materials as evidenced by the material collected and an outline presented to the instructor.

EQUIPMENT AND SUPPLIES NEEDED: Library facilities, pencil and paper

REFERENCE MATERIAL:

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this activity is to show the student how to go about gathering the information necessary to complete a printed copy.

   B. Key Points to be presented
      1. Trace the steps in getting information ready to prepare a paste-up.
      2. Emphasize the importance of the layout content (thus the need to compile the information).

   C. The teacher should provide examples of compiled information which is transferred into outline form.

2. Student Activity
   A. The student should decide on the main idea of the printed copy. (Just what it is that he wants to say in the copy.) Possibly a one page, consise, technical paper on some phase of communication could be assigned.

   B. The student should go to the library to continue research on how to go about getting the information to be printed.

   C. Possible resource methods for student use.
      1. Authority--to ask people who are an authority on subjects.
      2. Personal experience
      3. Deductive reasoning--taking general information to arrive at specific conclusions.
      4. Inductive reasoning-taking specific information to arrive at general conclusions.
      5. Scientific method--find all of the possible ways, choose a hypothesis experiment to prove it.

   D. After the student has compiled the necessary information he should prepare an outline. The outline should include:
      1. Stating the problem (the printed copy that you want.)
      2. Main segments of collected information
      3. Systematic arrangement of the information in to a useable sequence.

   The information which the student has collected and outlined should be readied before the next activity "Layout/Composition" occurs.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
3b, c. "Design layout, composition, and paste up"

Allow 5 class periods

OBJECTIVE: *The student will demonstrate his knowledge and skills in layout/ composition and paste-up as evidenced by a properly composed paste-up presented to the teacher.*

EQUIPMENT AND SUPPLIES NEEDED: Pencil, rubber cement, poster board, tracing paper, xacto knife, dry transfer letters

REFERENCE MATERIAL: Lithographic Platemaking Curriculum Guide not included
A.B. Dick Graphic Communication Series, not included

PROCEDURE FOR THE ACTIVITY

1. Teacher Information
   A. The purpose of this unit is to present procedures for design layout/composition to the student.

   B. Key Points to be presented
      1. A layout is sometimes called a dummy.
      2. Layouts shows how the printed copy should appear (except if printed in color)
      3. Layouts provide information to the typesetter, make-ready man, press-man and binder on how to do his job.
      4. Layouts may be changed by the customer before the actual printing is done. Changes made at this stage may result in a saving of time and money.

   C. Provide several paste-up examples.

2. Student Activity
   A. The student should take the information that he has compiled (from the previous activity) and use it to make the layout composition.

   B. The student should begin by making small thumbnail sketches--laying out where he wants each segment of information.

   C. Next, the student should make a rough layout on a standard size sheet of paper. A rough layout is a series of blocks or elements of copy and illustrations. The rough layout should indicate where displayed words and other elements belong.

   D. If the rough layout pleases the layout man, then visual or comprehensive layouts are made.

   E. The visual or comprehensive layout contains actual sizes of blocks, margins, and sizes of illustrations, with actual lettering. Drafting equipment should normally be used to layout the comprehensive.

ACTIVITY
"Design layout, composition, and paste up"

F. The finished layout is usually made up of photoprints of artist's work and proof of type pasted up to make work appear in form as though it was printed.

1. The element of harmony in typographic design refers to a pleasing relationship between the type face used and to the design.

2. Balance refers to equalized and pleasing elements of a printed job. Elements out of balance are easily seen, because the printing looks top
3. heavy or it may seem too heavy on the right or left.

3. Display means contrast. A work or line is displayed when it becomes more visible or readable through a contrast in weight, color, shape or size with other type matter on the page.

4. It should be remembered, too much display is not effective display. Only a few elements should be displayed in any one piece of printed matter. The readers eye can be attracted only by a few elements or lines.

Examples of Display Methods
1. A type of another type family.
2. A type of same type family, but condensed.
3. By underscoring.

5. Hard-surface papers do not thicken the type faces, and soft-surfaced papers do thicken them. Type faces appear to be heavier when printed on hard-surfaced papers.

G. Student should complete paste-up for this activity.

3. Other Possible Projects
1. Make a collection of cutout examples of handlettering used appropriately in newspaper and magazines.
2. Make thumbnail sketches of a project.
3. Make layout of business cards, letterheads, billheads.
4. Make a collection of printed matter and practice redesigning each piece.

4. The paste-up will be used in the following activity.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

C. Presented Media

ACTIVITY
3d. "Making a Plate"

Allow 2 class periods

OBJECTIVE: Upon completion of this activity the student will be able to make an offset plate, as evidence by the copies printed in the next activity.

EQUIPMENT AND SUPPLIES NEEDED: Offset plates, a plate maker, offset negatives, plate making chemicals, and three example plates (metal, plastic, paper)

REFERENCE MATERIAL: LITHOGRAPHIC PLATE MAKING CURRICULUM GUIDE, by Kodak not included

1. Teacher Information

   A. The purpose of this activity is to teach students the types of plates which may be made and to teach students how to make a plate.

   B. Explain a plate to the students.

      1. A plate may be made from a thin sheet of metal, plastic or paper.

      2. Allow the students to examine the three basic types of plates.

      3. Note that the plates which the students will be using will be chemically coated.

      4. The coated material is sensitive to light. The plate maker exposes the plate.

2. Teacher Demonstration

   A. Demonstrate the proper operation of the platemaker.

3. Student Activity

   A. Procedure for preparing a plate. (Assumes a self contained platemaker, i.e., A.D. Dick , other.)

      1. Place the paste-up in the platemaker face up.

      2. Place a negative on top of the paste-up, emulsion side down (yellow side).

      3. Turn the paste-up and negative over.

      4. Adjust for correct exposure (about 3½ seconds for A.B. Dick platemaker). Press expose switch.

5. After exposure, insert the plate under plastic lip on the left of the exposure area. Turn knob clockwise until the plate stops.

6. Place exposed negative on top of plate, yellow side down, on top of plastic lip on the left of the exposure area.

7. Engage the switch, allowing the plate and negative to move through the chemical solution on the left of the machine.

8. After the plate and negative come out of machine, and after knob stops turning, pull the negative and plate apart.

9. Pour a small amount of the fixer on the metal plate. Rub the plate with a cotton pad.

10. Pour a small amount of lacquer (red) on the plate and rub for approximately 20 seconds with a cotton pad.

11. Take clean cotton pad with a small amount of fixer and clean plate.

B. Save the plate as it will be used for next activity--printing.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

C. Presented Media

ACTIVITY
3e. "Printing"

Allow 3 class periods

OBJECTIVE: Upon completion of this activity the student will have printed as evidenced by copies prepared for use in the next activity.

EQUIPMENT AND SUPPLIES NEEDED: Offset press, supplies needed for necessary printing

REFERENCE MATERIAL: Manual on Operation of Offset Press not included

1. Teacher Information

   A. The purpose of this activity is to introduce students to printing, using either the offset press, spirit duplicator, or mimeograph machine.

2. Teacher Demonstration

   A. Demonstrate the operation of the duplicating machine. Be sure to emphasize safety precautions of the machine. Reinforce the demonstration by lecturing on the similarities of duplicators and by presenting components which make up the duplicator/press.

   B. Prepare the press/duplicator for use by students.

3. Student Activity

   A. Wash the plate that was made in the previous lesson.

   B. Mount the plate on the press as demonstrated by the teacher.

   C. Follow the steps of printing as required for proper operation of the duplicator/press being used.

   D. Print 15 copies.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

ACTIVITY
3f. "Collate and Assemble Materials"

C. Presented Media

Allow 2 class periods

OBJECTIVE: Upon completion of the activity the student will have a knowledge of how to assemble printed material as evidence by the bound documents.

EQUIPMENT AND SUPPLIES NEEDED: Printed copies and stapler

REFERENCE MATERIAL: FINISHING PROCEDURES, A.B. Dick series not included

1. Teacher Information

   A. The purpose of this activity is to provide the student with collating, assembling, and stapling methods.

2. Teacher Presentation

   A. Discuss collating, gathering, assembling, stacking, and stapling.

   B. Relate the processes to large plant operations.

   C. Key points to mention:

      Gathering may be done directly from press by mounting the gathering equipment on the press.

      Each imaged sheet is directed into a seperate bin.

      The sheets are gathered as they are imaged.

      Many single sheet gathering machines are called collectors.

      Gather means to assemble sheets of paper.

      Collate means to check gathered sheets for accuracy.

3. Student Activity

   A. Each student should assemble his document. The student should do his gathering by hand. The student should lay out his printed material in the form that he selects. He should begin by collating the material. After this is done the material should be readied for stapling. Stapling is completed by using pre-formed wire staples. Stitching is completed by using wire taken from a roll. The student will probably staple by hand.

   B. The assembled materials will be used in the next activity.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
C. Presented Media

ACTIVITY
3g. "Distribution of the Product"

Allow 1 class period

OBJECTIVE: Upon completion of this activity the student will be able to distribute the copies that he has printed as evidence by handing out the printed copies.

EQUIPMENT AND SUPPLIES NEEDED: Printed copies

REFERENCE MATERIAL:

1. Teacher Information

   A. Communicating with the public and the user of the products and services of the company is the job of the sales and distribution personnel.

   B. Sales and distribution processes include everything that is required to get the finished product from the final point of manufacture to the customer.

   C. Distribution involves various steps, such as warehousing, handling, packaging, services of the plant, transportation to the customer, and services needed once the product has been received.

2. Teacher Presentation

   A. Discuss the key points included in teacher information.

3. Student Activity

   A. The student should decide on how he will distribute his product. He may choose mailing, handing out, stacking in a convinent place, or any of several other methods.

   B. Encourage the students to select unique distribution methods.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT

D. Preparing Service Information

ACTIVITY
1. "Selecting Information for Service Sheet"

Allow 1 class period

OBJECTIVE: Upon completion of this activity the student will have determined the information necessary for the service sheet as evidenced by list of selected information.

EQUIPMENT AND SUPPLIES NEEDED: Library as resource, pencil, and paper

REFERENCE MATERIAL:

1. Teacher Information
   A. Service information may be any type of information that is needed to accompany the product.
2. Student Activity
   A. The student should select the information he is going to use with the product.
   B. Student should review different product service information sheets.
   C. The type of information used to explain a product should be reviewed.
   D. Student should decide on possible information for his product.
   E. Now collect the specific information to be used. Should be collected and listed.
   F. The information collected should be available for the next activity.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
D. Preparing Service Information

ACTIVITY
2. "Decide on Form of Dissemination"

Allow 1 class period

OBJECTIVE: Upon completion of the activity on Forms of Dissemination the student will have selected the form of dissemination that he will use for service information as evidence by the distributed information.

EQUIPMENT AND SUPPLIES NEEDED: Log of different forms of dissemination and methods of disseminations.

REFERENCE MATERIAL:

1. Teacher Information

   A. The purpose of this activity is to show the student various forms and methods of dissemination.

2. Teacher Presentation

   A. Show the students possible forms of dissemination. (Brochure, catalog, post cards, banners, posters, call cards, etc.)

   B. Some points for the student to consider when deciding on the form of dissemination:

      1. Who is the receiver?
      2. What type of information is to be sent?
      3. Is the information large or small?
      4. Can it be mailed, handed out, or distributed by some other menas?
      5. Is the information going to be packaged with the product?
      6. Will it be printed on the package?
      7. Will it be placed on the product?

3. Student Activity

   A. Select the form and method to disseminate their assembled product. Be sure to encourage the students to consider the above key points.

   B. The products will be used later so do not destroy.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
D. Preparing Service Information

ACTIVITY
3. "Compiling Information"

Allow 2 class periods

OBJECTIVE: Upon completion of this activity the student will have compiled the necessary information for preperation of service information as evidenced by the compiled information.

EQUIPMENT AND SUPPLIES NEEDED: Library facilities, pencil, and paper

REFERENCE MATERIAL:

1. Teacher Information

   A. The information covered will concern preparing service information. The service information will be prepared and disseminated.

   B. This activity will show students how to gather the information necessary to prepare service information.

   C. Examples of service information should be shown to the students.

2. Student Activity

   A. The student will need to decide on the main idea of his service information--(what is it that he wants to tell the consumer about his servicing this product).

   B. The student should go to the library to research information on related products.

   C. After the student compiles the necessary information he must compile an outline.

      The outline should include:

      1. Stating the problem (the printed copy you want)
      2. List the key elements of the problem solution.
      3. Include the key points from the collected information.
      4. Select the information needed.
      5. Put the information toegther in a sequence that can be used.

   D. The student will need to have the above information collected in order to compose the information in the following activity.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
D. Preparing Service Information

ACTIVITY
4. "Composing Information"

Allow 1 class period

OBJECTIVE: Upon completion of the activity on composing information the student will have a knowledge of composing information for service information.

EQUIPMENT AND SUPPLIES NEEDED: Paper, pencil, and library

REFERENCE MATERIAL: A GUIDE TO THE BUYER OF TYPOGRAPHY, A.B. Dick Series not included

1. Teacher Information

   A. Review the reference material.

2. Teacher Presentation

   A. This activity is concerned with the student laying out the necessary service information. Student should be reviewed on layout/composition techniques.

3. Student Activity

   A. Student should make sketches of where he wants information, wording, illustrations, letters, or other material to be displayed in the service information sheet.

   B. The student should layout composition full size, with full size margins, and actual lettering.

   C. Student would recall balance, movement, unity, display value, and harmony factors when composing.

   D. The student should make an exact copy of the service information, the way it is to be printed.

   E. Proofread all information for accuracy.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
D. Preparing Service Information

ACTIVITY
5. "Selecting the Method of Dissemination"

Allow 1 class period

OBJECTIVE: Upon completion of this activity the student will have selected the method that he will use to disseminate his information.

EQUIPMENT AND SUPPLIES NEEDED: Examples of method of dissemination

REFERENCE MATERIAL:

1. Student Activity

   A. Student should consider different methods of dissemination.

      Examples of Methods of Dissemination

      By mail
      On product
      Inside container
      On container
      On package

   B. Student should select the method that he thinks will be best for his product.

   C. Disseminate the information.

SECTION III. SYNTHESIS THROUGH PRODUCT DEVELOPMENT
E. Preparation for Distribution

ACTIVITY
1. "Design Packaging for Product"

Allow 2 class periods

OBJECTIVE: *Upon completion of the activity the student will be able to design a package for a product as evidenced by the package that he has designed.*

EQUIPMENT AND SUPPLIES NEEDED: Xacto knives, paper, container needed for product, necessary equipment for artwork

REFERENCE MATERIAL: A.B. Dick series on art work not included
DESIGNING TODAY.S MANUFACTURED PRODUCTS, Lindbeck, pages 213, 214 included packaging pages 129-146 (listed under Rough Sketch the Ideas activity)

PROCEDURE FOR THE ACTIVITY

1. The information that will be covered in this activity will be on designing a package.

2. Key Points
   A lot of art work will be used in this activity.
   This unit will try to use just the basic elements of art to get the design.

3. If any way possible the teacher should have a demonstration on designing and all of the examples possible on package designing.

4. A. Student should do thumbnail sketches of different design. (notation: ref.)

   B. Remember the product that you are designing.
      a. How large is it?
      b. What shape is it?

   C. What kind of people are you going to sell the product to?
      Example:
      a. Young people
      b. Older people
      c. Middle age group
      d. Rich people
      e. Middle class people

   D. Pick colors to go with age group. (if color is used)

   E. When using art work refer to the elements and principles of design.

5. Evaluate if necessary.

6. Distribute product.

ACTIVITY
"Design Packaging for Product"

Principles of Design

- Proportion
- Balance
- Unity
- Contrast
- Rhythm
- Harmony
- Repetion

Elements of Design

- Line
- Texture
- Color
- Shape

DESIGNING TODAY'S MANUFACTURED PRODUCTS, Lindbeck, pages 213-214

Packaging

The efficacy of foamed plastics in packaging applications has been long appreciated by producer and consumer alike. The telephone system component, for example, is housed in a light, yet strong carton made from foamed polystyrene beads. What makes this such a desirable packaging material is the additional factor of ease of manufacture. Cartons tailored to fit any product configuration can be produced quickly and simply, and at a relatively low cost. Such packaging systems are especially desirable for shipping delicate electronic and medical components. Similar packages of flexible foams are also available. A wide range of other rigid foam shapes are made for craft, construction, and insulation purposes.

APPENDIX A

DEFINITION OF BEHAVIORAL OBJECTIVE

*The three levels of behavioral objectives are: cognitive, affective, and psychomotor. To describe the variable of cognitive and affective behavior, definitions from Bloom and Kratwohl are utilized. The definitions for psychomotor behavior are those described by Dave.

Cognitive Variables: Behaviors which place primary emphasis on the mental or intellectual process of the learner:
The levels are:

Knowledge- Involves the recognition and recall of facts (i.e., defining terms, recalling names, dates, persons, indentifying words, etc.)

Comprehension- The learner interprets, translates, summarizes, or paraphrases given material into another language or form of communication (i.e., reading a book or musical scores, grasping the thought of material studied, ability to describe something in one's own words, etc.)

Application- Involves the use of material in a situation which is different from that situation in which it was originally learned (i.e., the use of abstract ideas, principles, or theories in problem-solving).

Analysis- Involves separating a complex entity into its parts, drawing comparisons and relationships between the elements (i.e., ability to recognize assumptions, to distinguish cause and effect relationships, reorganization of biases or points of view, etc.)

Synthesis- Involves combining elements to form a new original entity. It involves a process of working with pieces, parts, elements, etc., and arranging them in a structure that was not clearly evidenced before (i.e. ability to produce a play, music, art forms, design products, or formulate solutions).

Evaluation- Involves acts of decision-making, judging, or selecting based on a given

Synthesis cont.

set of criteria. These criteria may be objective or subjective (i.e. ability to indicate fallacies, compare a work or an idea with known standards, etc.)

Affective variables: Behavior which primarily emphasizes attitudes, emotions, and values of the learner and are usually reflected by interests, appreciations, and adjustments. The levels are:

Receive- The learner is aware of, or passively attending to certain phenomena and stimuli (i.e., listening, being attentive to, etc.)

Respond-- The learner complies to given expectations by attending or reacting to certain stimuli or phenomena (i.e., obeys or participates as expected, etc.)

Value- The learner displays behavior consistent with a single belief or attitude in situations where he is not forced to comply or obey (i.e., demonstrates a definite preference, displays a high degree of certainty and conviction, etc.)

Organization* The learner is committed to a set of values as he displays or communicates his beliefs or values (i.e. develops a rationale for a set of values, makes judgments about sets of values).

Characterization* -The total behavior of the learner is consistent with the values he has internalized (i.e., develops a consistent philosophy of life, exhibits respect for the worth and dignity of human beings, etc.).

* Levels four and five are seldom used in performance objectives at the instructional level. Therefore, the educator may find these levels inappropriate for us in writing performance objectives to be achieved over short time periods.

Definitions cont.

Psychomotor Variables: Behaviors which place primary emphasis on neuro-muscular or physical skills involving various degrees of physical dexterity. The levels are:

1. Imitation- When the learner is exposed to an observable action, he begins to make covert imitation of that action. Such covert behavior appears to be the starting point in the growth of psychomotor skill. This is then followed by overt performance of an act and capacity to repeat it. This performance, however, lacks neuromuscular coordination or control, and hence is generally in a crude and imperfect form (i.e., impulse, over repetition).

2. Manipulation- Emphasizes the development of skill in following directions, performing of selected actions, and fixation of performance through necessary practice. At this level, the learner is capable of performing an act according to instruction rather than just on the basis of observation as in the case at the level of imitation (i.e., following directions).

3. Precision- The proficiency of performance reaches a higher level of refinement in reproducing a given act. The learner performs the skill independent of a model or a set of directions. Here, accuracy, proportion, and exactness in performance become significant (i.e., reproduction, control, errors reduced to a minimum).

4. Articulation-Emphasizes the coordination of a series of acts by establishing appropriate sequence and accomplishing harmony or internal consistency among different acts (i.e., performance involves accuracy and control plus elements of speed and time).

5. Naturalization- A high level of proficiency in the skill of performance of a single act is required. The behavior is performed with the least expenditure of psychic energy. The act is routinized to such an extent that it results in automatic and spontaneous response (i.e., performance becomes natural and smooth).

Developing and Writing Performance Objectives, Booklet #2, Educational Innovators Press, P.O. Box 13052, Tucson, Arizona, 1971.

APPENDIX B

DEFINITION OF TERMS

DEFINITION OF TERMS

APERTURE--the lens opening obtained by adjusting the diaphragm. Openings are expressed in f/stop numbers.

AUDIO--those areas of communications dealing with sound.

COLLATE--checking sheets for proper order.

COMPOSITION--the placement of parts in an original.

DENSITY--the amount of build-up of film grain resulting from exposure and processing.

DIAZO--a method of reproducing images on a sensitized carrier. Carrier is sensitive to high intensity ultra-violet light. (Also called white print)

DIRECT IMAGE-- image carrier prepared by direct writing, typing, drawing or printing.

ELECTROSTATIC--a dry process of copying. Uses a very fine powder, which is fused to image carrier by heat.

EMULSION--the light sensitive coating of a film or paper to record an image. Appears black after exposure to light and development.

FINISHING--the process of binding printed materials together.

HALFTONE--a photograph broken into a series of extremely small dots.

HARD COPY--paper and other materials which have been printed.

LITHOGRAPHY--a method of direct image transfer. Works on the principle that water and ink will not mix.

MASTER--a direct image ink transfer carrier.

MODEL--an object constructed for showing the three-dimensions of a design.

ORTHOCHROMATIC--an emulsion or light sensitive coating, insensitive to red light but sensitive to the blue-green portion of the light spectrum.

PANCHROMATIC--emulsion which is sensitive to a wide range of colors.

PASTE UP--a design copy which is ready for photographing. Precise positioning is required.

PHOTOGRAPHY--process of recording images on a light sensitive material by light energy.

RELIEF--process of transferring images from a raised surface.

STENCIL--a piece of thin material perforated so that when ink or paint is applied to it, an image can be produced.

VIDEO--those areas of communications dealing with the transmission or reception of an image.

APPENDIX C

S.E.T. PROJECT
INDUSTRIAL COMMUNICATIONS CURRICULUM

ATTITUDE INVENTORY TEST

ATTITUDE INVENTORY ANSWER SHEET

ATTITUDE INVENTORY TEST EVALUATION PROCEDURE AND KEY

INDUSTRIAL COMMUNICATIONS CURRICULUM

ATTITUDE INVENTORY

These questions are different from the usual school questions. They are about your attitude and have no right or wrong answers. You are not to put your name on the answer sheet and no one will know what your answers are. Read the statements carefully and answer all statements on the answer sheet.

1. In the communications class the role of printing in the total industrial communications process is shown.
2. Physical education is more fun than communications.
3. Communications is an important part of industry today.
4. This communications class is a lot of nonsense.
5. The communications course will help me in my future career choice.
6. I feel comfortable in the communications class.
7. I do not like to get my hands messy.
8. Working with ones hands is an undesirable characteristic of the occupations in communications.
9. I like to work with communications systems.
10. I understand and appreciate the value of simple communications systems.
11. The communication classes have helped me to think about my future.
12. Communications courses should not emphasize the relationships of drafting, printing and photography.
13. Safety need not be emphasized in communication classes because of the limited number of machines used.
14. Communications classes are more fun than building products in the materials and processes classes.
15. Communication systems do not make use of power and energy sources.
16. Communications systems of today are essential factors in our present standard of living.
17. In the communications class the role of drafting and design is shown as a part of the industrial communication system.
18. Eye appeal and design do not belong in the study of communications.
19. I prefer to work as a group member rather than individually in communication classes.
20. I would rather have the communication class taught by the lecture-demonstration method as compared to student activities.
21. Communication classes are an important part of school work.
22. Talking about communication systems is something I like to do.
23. I understand the industrial communications system.
24. I will probably enroll in a more specific communication course such as printing, drafting or photography in the future.

ATTITUDE INVENTORY ANSWER SHEET

DATE HOUR CLASS TEACHER

INSTRUCTIONS:

Circle the "yes" response if you agree with the statement; circle the "no" response if you disagree with the statement; circle the "undecided" if you are not sure how you feel.

1.	No	Undecided	Yes	13.	No	Undecided	Yes
2.	No	Undecided	Yes	14.	No	Undecided	Yes
3.	No	Undecided	Yes	15.	No	Undecided	Yes
4.	No	Undecided	Yes	16.	No	Undecided	Yes
5.	No	Undecided	Yes	17.	No	Undecided	Yes
6.	No	Undecided	Yes	18.	No	Undecided	Yes
7.	No	Undecided	Yes	19.	No	Undecided	Yes
8.	No	Undecided	Yes	20.	No	Undecided	Yes
9.	No	Undecided	Yes	21.	No	Undecided	Yes
10.	No	Undecided	Yes	22.	No	Undecided	Yes
11.	No	Undecided	Yes	23.	No	Undecided	Yes
12.	No	Undecided	Yes	24.	No	Undecided	Yes

KEY FOR EVALUATING ATTITUDE INVENTORY

The following statements should be considered positive with a "yes" response:

1, 3, 5, 6, 9, 10, 11, 14, 16, 17, 19, 21, 22, 23, and 24

The following statements should be considered positive with a "no" response:

2, 4, 7, 8, 12, 13, 15, 18, and 20

APPENDIX D

S.E.T. PROJECT
INDUSTRIAL COMMUNICATIONS

PRE–POST TEST

ANSWER SHEET AND KEY

INDUSTRIAL COMMUNICATIONS TEST

INSTRUCTIONS: Answer all questions on the answer sheet.

1. Who would probably prepare the service manual for a product?

   A. Editors
   B. Illustrators
   C. Writers
   D. All of the above

2. What is the purpose of sketching?

   A. Show how the product is made.
   B. What materials the product is made of.
   C. To replace working drawings.
   D. To place an idea on paper.

3. A drawing which shows three views would be classified as a:

   A. Pictorial drawing
   B. multi-view drawing
   C. Isometric drawing
   D. None of the above

4. If you have a given light intensity, f-stop and shutter speed but find the negative when developed properly is too dark, which of the following could be used on subsequent pictures to correct the exposure?

   A. Increase shutter speed
   B. Increase f-stop value
   C. Decrease shutter speed
   D. Decrease light intensity with a filter

5. The ideal temperature for film processing is:

   A. 72° F
   B. 66° F
   C. 68° F
   D. 80° F

6. Cameras are normally mounted on a:

   A. tripod
   B. dolly
   C. stationary object
   D none of these

7. Non-directional microphones pick up sound from:

   A. all directions
   B. one direction
   C. from the top of the mike
   D. all of the above

8. The gray scale in television production refers to:

   A. different steps from black to white
   B. a gray card scale
   C. a means for measuring light
   D. none of the above

9. A film or camera director must be concerned with:

   A. the performer
   B. the lighting
   C. cue cards
   D. all of the above

10. When all the elements of a design have been placed in a sense of equilibrium the layout has been:

    A. proportioned
    B. harmonized
    C. balanced
    D. reduced

11. A negative should be placed in an enlarger:

    A. glossy side down
    B. dull side down
    C. either way
    D. wet surface up

12. Man communicates most of his ideas by which sense?

    A. sound
    B. sight
    C. touch
    D. taste

13. The proper angle for making the strongest splice on a magnetic tape is:

    A. 90°
    B. 60°
    C. 45°
    D. 30°

14. White prints are products of the:

    A. silver process
    B. electrostatic process
    C. heat process
    D. Diazo process

15. The developer used for making white prints is:

A. water
B. silver bromide
C. hypo
D. ammonia

16. The primary colors used in offset printing are:

A. red, yellow, and green
B. green, yellow and orange
C. blue, red and yellow
D. none of these

17. That form of printing which commonly uses quoins, type and furniture is called:

A. letter press
B. offset press
C. silk screen printing
D. Itaglio printing

18. Half-tones are necessary when printing:

A. heavy lines
B. large print
C. photographs
D. colors

19. Thermofax is a reproduction method using:

A. heat
B. ink
C. light
D. none of these

20. Hard copy is best exemplified by:

A. printing
B. models
C. stencils
D. scripts

21. A blueprint is considered a:

A. positive
B. negative
C. master
D. original

22. When operating a television camera you must be concerned with:

A. focus
B. F-stop
C. depth of field
D. all of the above

23. Most magazines and books are printed by a:

A. spirit process
B. offset process
C. relief process
D. none of the above

24. Itaglio is a:

A. method of printing
B. inventor of a printing press
C. style of lettering
D. famous designer

25. Which type of model includes all details and has working parts?

A. paste-ups
B. clay
C. prototype
D. scale

26. The electro-static copying process is common to:

A. white prints
B. Xerox
C. spirit
D. diazo

27. When processing photographic paper, an image becomes visible:

A. immediately when exposed
B. during the fixing
C. during the developing
D. during the drying

28. Gathering of data is commonly known as:

A. design layout
B. engineering
C. illustrating
D. none of the above

29. When examining a picture you find the subject blurred but the area surrounding the picture in sharp focus. Which of the following could be used to correct the problem?

    A. Use a faster film
    B. Use a small lens opening to provide less depth of field
    C. Set the shutter speed to a higher value
    D. Use a slower film to decrease sharpness

30. On an adjustable camera lens, which lens opening allows the least amount of light through?

    A. f 16
    B. f 11
    C. f 4.5
    D. f 8

31. The device used for projecting an image onto print paper is called a:

    A. contact printer
    B. easel
    C. enlarger
    D. copy camera

32. The process during which all images are assembled in the precise positions required for photo conversion is called:

    A. typesetting
    B. idea sketching
    C. paste-up
    D. composition

33. An exploded pictorial assembly drawing is most likely used for:

    A. instruction manuals
    B. material order
    C. advertising
    D. production

34. The main function of a Diazo machine is to:

    A. store information for later retrieval
    B. enlarge photographs
    C. reduce photographs
    D. make reproductions

35. A process where ink and water are used together is:

    A. photography
    B. diazo
    C. Xerox
    D. Lithography

36. Hard copy, projected copy and electronic are forms in which communications products are:

A. Disseminated
B. Stored
C. Evaluated for feedback
D. All of above

37. Scripts are used to guide:

A. performers
B. producers
C. cameramen
D. all of above

38. Preliminary design ideas are recorded in the form of:

A. sketches, notes, and worksheets
B. working drawings
C. photographs
D. all of the above

39. Which of the following requires a halftone positive for proper reproduction of continuous tone photographs?

A. letterpress cuts
B. photo drafting
C. offset lithography using a process camera
D. contact printing or enlarging

40. The formulating, recording, and expressing ideas on paper would be an example of:

A. working drawings
B. sketches
C. perspective drawing
D. rendered pictorials

41. A rendered pictorial would normally be a projection.

A. isometric
B. sketch
C. multiview
D. oblique

42. An exact and accurate means of describing an object is:

A. sketching
B. detail drawings
C. illustration
D. silk screen

43. In developmental research the first process would be to:

A. develop an idea
B. collect data
C. evaluate information
D. describe information

44. Both audio and video tape work on the principle of:

A. vibration-sensitive receptors
B. electro-static energy
C. electromagnetism
D. wave interpretation

45. ASA is the rating of:

A. photographic film
B. camera lens
C. enlarging paper
D. photo chemicals

46. Panning of the T.V. camera means:

A. tilting the camera up and down
B. elevating or lowering the camera on a pedestal
C. turning the camera from left to right or right to left
D. all of the above

47. What type of drawing is required for the fabrication of a product?

A. assembly
B. detail
C. pictorial
D. illustration

48. What is the career occupational classification of a draftsman?

A. semi-skilled
B. professional
C. skilled
D. laborer

49. People communicate ideas:

A. to express feelings
B. because of a human need
C. to relate information
D. all of the above

50. Industrial Communications Technology is the study of:

A. man's communications with man
B. man's communications with machine
C. machine's communications with machine
D. all of the above

S.E.T. PROJECT INDUSTRIAL COMMUNICATIONS CURRICULUM ANSWER SHEET

DATE _____ HOUR _____ NAME _____

CLASS _____ STUDENT # _____

INSTRUCTIONS:

Circle or black out the letter of the correct response; choose only the one best answer. Make no marks on the test. Mark all answers on this sheet.

1. A B C D	21. A B C D	41. A B C D
2. A B C D	22. A B C D	42. A B C D
3. A B C D	23. A B C D	43. A B C D
4. A B C D	24. A B C D	44. A B C D
5. A B C D	25. A B C D	45. A B C D
6. A B C D	26. A B C D	46. A B C D
7. A B C D	27. A B C D	47. A B C D
8. A B C D	28. A B C D	48. A B C D
9. A B C D	29. A B C D	49. A B C D
10. A B C D	30. A B C D	50. A B C D
11. A B C D	31. A B C D	
12. A B C D	32. A B C D	
13. A B C D	33. A B C D	
14. A B C D	34. A B C D	
15. A B C D	35. A B C D	
16. A B C D	36. A B C D	
17. A B C D	37. A B C D	
18. A B C D	38. A B C D	
19. A B C D	39. A B C D	
20. A B C D	40. A B C D	

KEY FOR INDUSTRIAL COMMUNICATIONS PRE–POST TEST

Correct Responses:

1. D	2. D	3. B	4. C	5. C	6. A	7. A	8. A	9. D	10. C
11. B	12. B	13. B	14. D	15. D	16. D	17. A	18. C	19. A	20. A
21. B	22. D	23. B	24. A	25. C	26. B	27. C	28. D	29. C	30. A
31. C	32. C	33. A	34. D	35. D	36. D	37. D	38. A	39. B	40. A
41. A	42. B	43. A	44. C	45. A	46. C	47. A	48. C	49. D	50. A

The instructor should evaluate each pre-test and record the results for comparison with the overall test results to find possible areas of strengths and weaknesses in the class. The post-test results should be compared to the pre-test to see if the performance objective was met.

APPENDIX E

RECOMMENDED EQUIPMENT LIST
FOR
INDUSTRIAL COMMUNICATION SYSTEMS
CURRICULUM

RECOMMENDED EQUIPMENT LIST FOR COMMUNICATIONS COURSE

1. Electric typewriter. Selectric preferred.
2. Spirit duplicator
3. Rubber stamp press
4. Cold type set
5. Paper shears or cutter
6. Offset duplicator press
7. Light table
8. Plate maker
9. Paper punch
10. Saddle stitcher
11. Jogger
12. Strip printer
13. Diazo printer-developer
14. Enlarger for 35mm and 2¼ film format
15. Darkroom sink with mixing valves
16. Totary print dryer
17. Leroy lettering set
18. Basic darkroom equipment for b/w
19. 35mm SLR full frame camera
20. 35mm SLR half frame camera
21. 2¼" twin lens camera
22. Simple box camera
23. Copy camera and stand
24. T.V. camera and monitor set
25. Video tape recorder
26. Tripod and dolly
27. Cassette tape recorder
28. Silk-screen frames
29. Refrigerator
30. Drawing tables—basic equipment
31. Platen press 5" x 7"

APPENDIX F

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