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An Innovative Instructional Unit on Manufacturing Concepts and Terminology for Junior High Industrial Arts

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AN INNOVATIVE INSTRUCTIONAL UNIT ON MANUFACTURING CONCEPTS AND TERMINOLOGY FOR JUNIOR HIGH INDUSTRIAL ARTS

An Abstract of a Thesis

Submitted

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

University of Northern Iowa

by

James K. Martin

July 1977

ABSTRACT

Although educators recognize the need for educational experiences that provide students with a basic understanding of the industrial technologies, too often students are not receiving the "hands-on" experiences related to industry. Numerous curriculum programs have been developed to provide the teacher with the necessary instructional materials and also provide students with educational-occupational guidance for the world of work. Yet, many of these programs are not being utilized by industrial arts educators.

Research has shown that most manufacturing curricula range from one to two semesters in length. In order for the teacher to wholly adopt one of these programs, considerable organizational and preparational work is required. Many teachers fail to take on this challenge. With this in mind, how would teachers and students react to a one-week introductory program that would be completely self contained with hands-on experiences related to manufacturing concepts and terminology? The search for an answer to this question was the primary concern of this study.

To investigate this problem, on instructional program entitled "The Enterprise System" was developed and the co-operation of a junior high school instructor was solicited. Two intact junior high school classes were randomly assigned. One group received the instructional unit and the other group served as a control group which received their traditional unit of instruction.

A quasi-experimental design was employed to determine the effect of the independent variable (method of instruction) on the dependent variable (achievement of manufacturing concepts and terminology). The subjects were measured by a posttest employing multiple choice questions. Test items were developed in relation to selected behavioral objectives. The data collected during the experimental study was subjected to the t-test to compare the means for statistical significance. The t-value and significant level of .05 provided the index for accepting or rejecting the hypothesis.

An attitude questionnaire was also developed to provide feedback from the students in the experimental group. It was not designed to draw any comparisons between the eximental group and the control group. The questionnaire was merely designed to see if the experimental group did have a positive attitude towards this method of instruction.

The primary conclusion reached was that the experimental group showed significantly higher achievement of manufacturing concepts and terminology than the control group. Secondly, the experimental group exhibited a generally positive attitude toward the manufacturing unit of study.

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This Study by: James K. Martin

Entitled: AN INNOVATIVE INSTRUCTIONAL UNIT ON MANUFACTURING CONCEPTS AND TERMINOLOGY FOR JUNIOR HIGH INDUSTRIAL ARTS

has been approved as meeting the thesis requirement for the Degree of Master of Arts

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

THE PROBLEM

Introduction

In the past few years, colleges and universities offering industrial arts have or are revising their teaching techniques and methodologies in order to better equip industrial arts educators. One of the reasons for this change is the rapid development of our nation's industrial technology from which industrial arts draws its content. Industrial arts education permits students to study the industrial and technological nature of our society. Therefore, it is necessary to keep our curriculums updated and correlated with our nation's industries in order to offer a more valuable learning experience for our students.

According to Maffet (1970), in the process of updating curriculum programs, several new approaches have been recognized and accepted throughout the country. Such programs include:

1. The Galaxy Plan
2. The Maryland Plan
3. Industrial Arts Curriculum Project
4. Industriology Project

5. The Orchestrated Systems Approach

These innovative programs have contributed greatly to the field of industrial arts education. They have provided the teacher with excellent instructional materials with which to implement his/her program. Yet, for one reason or another, many of these production type programs are not widely utilized by teachers in industrial arts education. One possible explanation is that too often the teacher hesitates to adventure into production type curriculums because of the time it takes to organize and prepare an effective course or because the length of the new program does not adapt well to existing class schedules. Most instructional programs are designed to be completed within one to two semesters. This presents somewhat of a problem for industrial arts teachers. Either they must adopt the program in its entirety and revise their curriculums, or they can incorporate key concepts from these programs into their existing programs. Another possibility is that the teacher is unfamiliar with manufacturing concepts, and therefore is unwilling to change and try new production type curriculums. Whatever the case may be, if industrial arts is to fulfill its major objective of giving each student an understanding of the industrial society in which he/she lives, "custom manufacturing in the schools must give way to production type experiences (Sredl and Travis, 1968, p.43)."

The instructional programs mentioned earlier in this chapter have been designed and developed for implementation at the junior high school level and have progressed through the senior high level. The rationale is that the concepts of these programs will be expanded and incorporated within industrial arts curriculums at the secondary level of education.

A questionnaire study developed by James L. Thiesse (1975), shows that eleven percent of the Iowa junior high/middle schools adopted one of the innovative industrial arts curriculums. Thiesse's study further shows that thirty-two percent of the junior high/middle schools which were not using innovative curriculums were using one or more of the learning activities associated with these instructional programs. This study was limited to 392 Iowa junior high/middle schools, and to senior high schools served by a junior high/middle school that indicated use of one of the instructional programs. This information pertained solely to industrial arts, not including vocational/technical curriculum information (Thiesse, 1975).

This pertinent information establishes a need to promote new innovative materials that will motivate industrial arts teachers into implementing a unit of study that relates to our industrial society. Instructional materials can be used to teach the basic concepts of manufacturing and the terminology used in industry. Such materials can also provide students with "hands-on" activities related to industry through mass production of a product. If the teacher can participate in a positive experience with minimum efforts and preparational work, he would then be encouraged to venture deeper into a production type curriculum. He could easily expand the basic concepts and design a unit of study that would fit his original curriculum or implement one of the accepted programs that are designed for a more in-depth manufacturing curriculum.

Statement of the Problem

If an introductory instructional unit on manufacturing concepts and terminology relating to modern day industry were presented to two comparable groups of junior high school industrial arts students, would there be a difference in the achievement of selected objectives if one group received the mass production technique and the other group continued to receive the traditional technique?

Statement of Research Hypothesis

Students who receive the instructional unit on manufacturing will show higher achievement of concepts and terminology in junior high industrial arts when compared with students receiving the traditional unit of study.

Assumptions

Assumptions relevant to this investigation are:

1. The students have had either an equal amount or no prior instruction related to manufacturing concepts and terminology.
2. The students were randomly assigned to the two study groups via the school's computerized scheduling system which allows for heterogeneous grouping of

students.

3. The students have had either an equal amount or no prior activity in mass-production.

Limitations of the Study

The limiting factors in this research study were:

1. Due to the cost and time factors, the sample was limited to junior high industrial arts students in the Cedar Falls, Iowa area.
2. The study was conducted within an actual school system by a cooperating teacher only once.
3. The research was limited to the principal and cooperating teacher who were willing and/or able to participate in the experiment.
4. The classes were previously established through the school's normal scheduling procedures.

Definition of Terms

Mass-produce: "to produce or manufacture in quantity; to produce considerable quantities of standardized commodities with the use of machine techniques--opposed to tailor-make (Webster's Third New International Dictionary, 1961, p. 1389)."

Mass production technique: The term "mass production technique" refers, in this study, to the writer's introductory instructional unit on manufacturing. This method involves introducing junior high school students to manufacturing concepts and terminology related to our modern day industry. This unit provides the teacher with a guide for implementing this unit. It also supplies a predetermined product, fully developed jigs, and fixtures in order to mass produce the product. The student class members assume the roles of persons in industry such as production planners, production workers, quality control inspectors, finishers, label designers, and product packagers. Students develop their processes and carry out the mass production activities.

Traditional technique: The term "traditional technique" refers, in this study, to a method of teaching industrial arts. Student activities within the school laboratory have been devoted primarily to the selection, design, and construction of custom projects. The teacher's lectures and demonstrations contributed to this teaching method in conjuction with textbook or reference material.

Control group: Those twenty students who were instructed by the traditional technique of teaching industrial arts were known as the "control group".

Experimental group: Those twenty students who were taught by the writer's mass production technique of teaching manufacturing were know as the "experimental group".

Chapter Summary

In the past fifteen years, numerous articles have been published in regard to our school's industrial arts curriculums. These authors reflect upon the rapidly developing technologies of our nation's industries. It is the belief of the writer, that educators of industrial arts hesitate to adapt curriculum changes because either they are unskilled to effectively teach the new curriculum or they find the new curriculum difficult and lengthy to organize. Therefore, there is a need to offer a prepared introductory unit on manufacturing that is organized and designed to benefit the teacher as well as to educate the students in relevant industrial related concepts. Once the teacher has the basic building tools, it is the aspiration of the writer that the instructor will then proceed to build or adopt a recognized, manufacturing program of industrial technology.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction of Innovative Programs

Industrial education has been in a constant state of modification since it was first introduced in the public schools of the United States. The emphasis was to make education relevant. According to Cochran (1970), industrial education should be relevant in content, teaching methods, and in its relationship to the technological society.

The concern generated for curriculum relevancy has resulted in the development of several innovative programs. The rationale for such programs (Cochran, 1970) is based on the premise of making education a unifying experience rather than fostering a plan of unrelated and self-contained courses. The objective of such innovative programs is to update existing industrial arts curriculums in order to focus upon technological advancements appropriate to our industrial society and to provide professional educators with instructional materials with which to implement these innovative programs.

In the attempt to validate the writer's instructional unit, a review of related literature was conducted in order to establish pertinent concepts and objectives for a manufacturing curriculum. This chapter summarizes recognized and accepted instructional programs mentioned in chapter one, along with the intention of describing various program structures that have contributed to the advancement of industrial arts education.

The writer's introductory unit of study incorporates, through this literature review, basic concepts, objectives, and terminology relevant to a manufacturing curriculum. The manufacturing unit was intended to provide the teacher with the basic building tools necessary for implementation of a successful unit of study with hands-on activities that simulate modern day industry. The impetus for developing this manufacturing unit was founded on the premise that once the teacher has completed a successful unit of study, he will then be encouraged to venture more deeply into a manufacturing type curriculum either by developing one of his own or adopting one of the recognized and accepted programs.

The Galaxy Plan

In a search for a better approach for educating students for the world of work, a group of teachers developed a program entitled "The Galaxy Plan". This program has been implemented in the junior and senior high schools in the Detroit, Michigan area. According to Turnquist (1965), the Galaxy Plan is an attempt to organize job skills into manageable groups which are similar in learning, manipulative, and attitude skills. The four major groups or fields of study are:

1. Material and processes which include the skills and knowledge in producing, shaping, forming, and assembling metals, wood, plastic, fabrics, and ceramics.
2. Visual communications which includes the popular drafting, graphic arts, and photographic industries.
3. Energy and propulsion which consist of development of energy and harnessing it for useful work.
4. Personal services group which comprises those jobs that involve contact with human beings or servicing human beings.

Turnquist (1965) notes that the curriculum is designed to be implemented in three phases. The phases identify the grade level where the content is intended to challenge students and permit a successful educational achievement relating to the world of work.

Phase one is a preliminary exploratory or search experience in industrial arts, homemaking, visual fine arts, music, and creative writing. A student club organization provides an opportunity to explore numerous vocational fields. This phase is intended to be implemented at the junior high school level, with heterogeneous grouping.

In phase two, the students are given an opportunity to expand their interests and explore more deeply a vocational occupation. This level is intended for the tenth grade. The emphasis is on a manipulative exercise that allows students to develop skills related to various selected areas.

During phase three, the students select a specific subject area and attempt to develop skills pertinent to the level of achievement required within the selected occupation. This level is designed as a two-year course for eleventh and twelfth grades. Parents and counselors assist the students with the objective of equipping them with specific salable skills.

The Galaxy approach requires a large number of students to fulfill the potentiality of the program. As a result, a large number of vocational instructors are also needed. Essentially, the Galaxy Plan strives to include learning experiences related to a vast number of occupations that reflect our technological society.

The Maryland Plan

The Maryland Plan was developed by Dr. Donald Maley at the University of Maryland in cooperation with the Montgomery County School System. His leadership in industrial arts education has provided the field with a junior high school program which promotes a student oriented approach to studying industry and technology. Dr. Maley (1973) states that industrial arts, as a curriculum area, is defined as:

> Those phases of general education which deal with technology--its evolution, utilization, and significance; with industry--its organization, materials, occupations, processes, and products; and with the problems and benefits resulting from the technological and industrial nature of society (p. 2).

The actual program was developed in a series of isolated components with the ultimate goal being a grade design for the junior high school. However, he states that the program has also been used in grades six through twelve.

The seventh grade uses the unit approach in which three proposed units are presented:

1. The development of tools and machines and their contribution to the growth of civilization.
2. The development of power and energy sources and their contribution to the growth of civilization.
3. The development of communication and transportation and their contribution to the growth of civilization.

These three units represent a study of basic elements common to mankind. Each has a direct relevancy to the content of industrial arts. Maley (1973) notes that each unit deals with the productivity and technological developments that have contributed to the stages of man's progress.

These three units implemented at the seventh grade level comprise the total year's program. Should less time be available, the teacher and students could choose to discuss any one of the three topics. The main objective is to develop an understanding of the three broad units that may be studied. The student activity would then be to construct a model or a display showing the evolution of his particular subtopic and present a report to the class (Maley, 1973).

The eighth grade program is based on the group project component. The idea is to elaborate upon the background and experiences the students have developed in the previous grade. The group process approach is designed to give the students an in-depth study of modern industry through group activities that include role playing and mass production. The class elects to study a certain type of industry and proceeds to play-out different roles within that industry. The objective at this level, is that through an in-depth study of a major industry, the class will be able to generalize about other industries.

Once the students have selected their industry, they identify occupations and job titles associated with their selected industry. They then proceed to organize and establish a production activity that enables them to discuss or interpret the problems and contributions of industry. The group approach is intended to develop skills, attitudes, leadership and followership through an in-depth study of industry.

The ninth grade level is designed to provide an emphasis on the psychological needs of the individual as well as on his resourcefulness, interests, capabilities, and problem solving skills. The units of study (Maley, 1973) are identified as contemporary units involved with all levels in either one class or classes that have been grouped by ability, interest, or other criteria. The objective at this level is to place each student in a unit of study that accommodates his or her interests and allows for a more extensive exploration of careers.

Another aspect of the ninth grade program includes a more in-depth production type experience. Additional media materials are used such as films, video-tapes, recordings, guest speakers, field trips, and letter and phone communications. Students experience realistic industrial situations in as many management and production systems as possible. The Maryland Plan program has been established throughout the nation. It is a program that has involved many years of developing and testing in order to establish its validity. It is indeed a contribution to the field of industrial arts education. It is a well organized program that allows teachers and students to be creative and involved in industrial related concepts.

Industrial Arts Curriculum Project

The Industrial Arts Curriculum Project (IACP) was developed through a joint effort by The Ohio State University and the University of Illinois. It began in 1965 when a funding proposal was approved by the United States Office of Education, with the purpose being: "to develop a rationale to guide the conceptualization of a more adequate structure of framework (IACP, 1966, p. iii)." A number of consultants from other academic, industrial, and professional organizations, as well as an advisory committee, provided the guidance for the project. The basic structure of the program is defined as industrial technology. The objective is to provide a sound basis for industrial arts for use at any level of the educational ladder (IACP, 1966).

The innovative industrial arts curriculum is designed to occupy two full-year courses, one being "The World of Construction" and the other "The World of Manufacturing". Both courses represent the basic concepts and principles of contemporary industrial technology while exposing students to industrial occupations. There are 185 days of assignments which include 97 different activities. Optional days are included to fit various school schedules. Students actually experience construction and manufacturing operations as performed in the actual industrialized world (McKnight, 1977).

In the first-year course, The World of Construction, students explore the technology of the building industry. They gain an understanding of industry's structure, relationship, opportunities, and requirements. The students participate in activities that provide learning experiences in building full size wooden frames, raising wall sections, fabricating roofs, installing utilities, and applying siding. Students then put their acquired knowledge to work in designing and building a model dream house.

The second-year course, The World of Manufacturing, teaches the concepts of researching, testing, designing, producing, and selling. The students learn the basic concepts of the manufacturing processes. They develop skills in designing and organizing a line production system, mass producing a product and assembling, packaging, and distributing their product through sales (McKnight, 1977).

The IACP was developed for industrial arts education in hopes of providing the field with a "cohesive, comprehensive, and internally consistent framework from which students can draw meaningful insight into that complex and productive societal enterprise--modern industry (IACP, 1966, p. vi)".

Industriology Project

The Industriology Project, funded under Title V of the Higher Education Act of 1965, was designed and developed by Jack Kirby and George Brown at Wisconsin State University, Platteville. Their primary objective was to develop an innovative program that would enable all students to better understand the technological world and help them adjust socially and occupationally to the conditions of industry.

The industriology concept (Cochran, 1970) does not replace industrial arts as a curriculum, but rather updates present day programs. The term "industriology" is described as (Cochran, 1970):

> . . . a broad comprehensive study of industry where the history, development, and implications of industry are explored through the industrial society, and suggest that the most important objective of the "Industriology Project" is to interpret industry to all students so they may be suitable citizens in an industrial society (p. 50).

The structure of this program is referred to as the "two-pronged" approach, with the first prong consisting of the history, development, and implications of industry. This phase of the program is broken down into six activities found in most industries: (1) development and design, (2) internal finance and office services, (3) manufacturing or processing, (4) marketing, (5) industrial relations, and (6) purchasing

(Cochran, 1970).

The second important part of this program deals with the various types of industries. The four types of industries have been identified as: (1) raw material industries, (2) manufacturing industries, (3) distributing industries, and (4) service industries.

The implementation of this program is intended to begin at the junior high school level and to extend through the senior high level of education. It consists of four major levels of study. The first phase is the development and structure of industry. This phase introduces junior high students to the four basic types of industries as well as the six related activities. Its major objective, is to present a broad overview of industry.

The second phase introduces the basic elements and processes of industry. It is intended to be presented to grades nine, ten, or eleven. This phase is broken down into short modules, each covering specific activities relating to the elements and processes of industry such as time and motion studies, quality control, and product development. The suggested time for each module is quite flexible, allowing the teacher to spend the necessary time to cover the details in each area.

The third phase is designed to offer a more in-depth study of specific industries related to the students' individual interests. The student selects a certain industry and conducts a comprehensive study starting with raw materials and proceeding through manufacturing, distribution, and sales. The objective is to provide the students with pertinent activities related to a specific industry such as metal working, woodworking, textiles or graphics.

The last phase, vocational and occupational guidance, is offered at grades eleven and twelve. This phase enables students to study industry strictly from an occupational view point. Its purpose is to prepare students for the world of work regardless of their chosen occupation.

The Orchestrated Systems Approach

This approach to industrial education was developed at Indiana State University by Lewis W. Yoho, Chairman of the Division of Industrial Education. The program was first developed in November of 1963 and later revised in 1964 and 1967. Its primary goal is to move the individual toward the "good life in society with dignity and capacity for responsible freedom and independent action (Yoho, 1967, p.4)."

According to Yoho (1967), education for developing competencies in communications is designed into the orchestrated system as a key goal gradient toward the pursuit of the "good life". Once communications competencies are developed, the individual may begin development of other goal gradients. The purpose and rationale for this type of an approach is expressed by Yoho (1967) in the following comment:

> The theory of teaching and learning for this systems approach is based upon developing individual self-motivation and self discipline for inves-

> tigation, discovery of new knowledge, and practice under anticipation for development of new and useful skills. The theory involves a plan for gaining adequate experienced samples from the orchestrated systems as a basis for seeking to match interest and talents before moving toward or polarizing around skill proficiencies (p. 35).

The Orchestrated System is designed to acquaint junior high students in four basic levels of study with an additional two levels for advanced studies in secondary education. The first level is designed for the beginning student in industrial education. The competency which the student would strive to accomplish is an understanding of the "whole" orchestrated system. The student works under an apprenticeship-type program in the production system until he is motivated by interest and newly discovered talents to begin concentrating on specific proficiencies.

The second level of the orchestrated system is designed to allow the students to develop vocational competencies. They pursue specialized goals and qualifications required of them to earn a living at a specific occupation. The goals or competencies established in this level set the pattern for all other goal gradients of the total system (Yoho, 1967). This level also includes comprehensive experiences and an understanding of industries. Topics that are discussed include: (1) technical industrial communication, (2) consumer goods manufacturing, (3) construction industries, (4) product servicing industries, and (5) product salvage industries.

Level three is a deeper involvement in one of the five topic areas presented in level two. This level provides the students with an opportunity to observe how each area relates to another, as well as to experience designing, engineering, production planning, and producing materials relevant to those areas.

Level four begins to identify specific content of industrial arts, industrial vocations, and industrial technical education. It deals primarily with manufacturing concepts such as research and development, tooling-up, marketing, and distribution of products. The competencies developed at this level, provide a path to follow in the fifth and sixth levels of secondary education if one were to continue the systems approach.

Chapter Summary

In the past several years, educators have realized the necessity to offer a more contemporary curriculum that reflects upon our industrial technological society. To accommodate this need, several innovative programs have been designed and developed for secondary-level industrial arts education.

Since the writer's instructional unit was designed to be implemented at the junior high school level, a review of literature was conducted to relate existing junior high programs and their objective to the writer's unique approach to teaching manufacturing concepts and terminology. It was the writer's intention to draw ideas from existing programs and develop a seven-day introductory unit that would give teachers and students a good, first level experience in the area of manufacturing. The instructional unit was also designed to provide the teacher with the necessary building tools and guidelines for developing a more comprehensive manufacturing curriculum.

CHAPTER III

METHODS AND PROCEDURES

Introduction

The foregoing review of literature has shown the structure of accepted instructional programs designed and developed for the betterment of industrial arts education. It further implies the need for the research and development of additional programs that apply to various educational institutions. An introductory instructional unit would acquaint both teachers and students with basic concepts of manufacturing as well as provide hands-on activities.

Investigation of this possibility led to the question with which this study was concerned. If an introductory instructional unit on manufacturing concepts and terminology relating to modern day industry were presented to two comparable groups of junior high school industrial arts students, would there be a significant difference in the achievement of selected objectives when one group received the mass production technique and the other group continued to receive the traditional technique?

In order to further investigate the effectiveness of the instructional materials, an attitude questionnaire was developed to provide immediate feedback from the students in the experimental group. The attitude questionnaire was not intended to draw any comparisons between the experimental group and the control group. The questionnaire was merely designed to see if the experimental group did have a positive attitude towards this method of instruction.

This chapter describes the methods and procedures employed in researching these questions. It describes the sample characteristics, research design, instructional materials, instrumentation, and data collection and analysis procedures.

Sample Description

The population for this study consisted of junior high school industrial arts students at Peet Junior High School in Cedar Falls, Iowa. Due to the inability to randomly assign the subjects, two intact eighth grade classes were utilized. Each class was heterogeneously grouped with a total of twenty students in the experimental group and twenty-one students in the control group. The two classes were assigned by computer to each industrial arts course. Therefore, it was assumed that the two groups were closely comparable in achievement and were not grouped according to ability, sex, or any other criteria.

To further investigate the two groups, a frequency distribution, consisting of test grades compiled during the first semester's studies in industrial arts along with each student's percentile rank score on the Iowa Test of Basic Skills composite, was evaluated. The results on the ITBS composite scores revealed that the experimental group had a median score of sixty-nine, while the control group had a median score ot seventy-nine. The frequency distribution of the test scores compiled from the previous semester's industrial arts studies clearly revealed through inspection of tables 1 and 2 that the two groups were quite closely aligned in terms of achievement.

Permission to conduct the research was granted by the principal at the junior high school. Following a consultation with the cooperating teacher, who had volunteered to conduct the experiment, one class was randomly assigned to be the experiment group and the other served as the control group.

TABLE 1 GRADE FREQUENCIES ON EXAM I

Grade	Experimental Group	Control Group
A	1	1
B	11	11
C	8	9

TABLE 2 GRADE FREQUENCIES ON EXAM II

Grade	Experimental Group	Control Group
A	5	8
B	6	4
C	9	8
D	0	1

Research Design

In this research study, the investigator was interested in developing and evaluating an introductory instructional package that would possess basic manufacturing concepts and terminology relevant to our society. Due to the fact that the writer was unable to establish randomization of the subjects within the sample, a quasi-experimental design was selected. It is understood that with a quasi-experimental design, the researcher has limited experimental control. However, according to Huck, et. al. (1974), quasi-experimental designs can be used when true experimental designs are not possible. He further states:

> With a quasi-experimental design the researcher does not have total control, but he can control one or two or the following: when the observations are made, when the treatment or independent variable is applied, and which intact group receives the treatment (p. 301).

The writer employed a post-test only control-group design and attempted to conceive control of the extraneous variables that were the limiting factors of this research design. The internal and external validity threats outlined by Campbell and Stanley (1963) were controlled in the following manner:

Internal Validity

1. History was a slight threat since only one teacher was used.
2. Maturation was controlled due to the short length of the treatment and the fact that the control group received the traditional treatment at the same time the experimental group received the mass production technique.
3. Testing was controlled since no pretest was given.
4. Instrumentation was controlled since the posttest was an objective measure.
5. Statistical regression was not applicable since the students were not selected on the basis of extreme scores.
6. Selection: Although the students were not randomly assigned by the researcher, they were assigned by the school with no known biases.
7. Mortality was not applicable since no students dropped out of the research study.

External Validity

1. Reactive effects of testing was controlled since no pretest was administered to either group.
2. Interaction of experimental treatment was a slight threat since only one teacher was used to conduct the experiment.
3. Artificiality of experimental treatment was a slight threat since the treatment consisted of newly developed materials.
4. Multiple treatment interference was controlled since the two groups had had no experimental treatments during the previous semester.

Post-test Only Control Group

T_e 0
- - - - - - - - - - - - - - - - - - - -
T_c 0

T_e = Experimental group

0 = Posttest administered after treatment

T_c = Control group

Dotted line indicated that the two groups are not randomly assigned

Independent Variable

The independent variable was the method of instruction, manipulated by the instructor of the two classes. The instructional unit was completely organized for the instructor. It contained a teacher's guide that outlined each day's activities including topics that the instructor presented to the students and activities for student participation. The researcher supplied all necessary tools and equipment needed to conduct the experiment.

The control group continued the traditional method of instruction. The teacher met with the students to discuss their progress and then supervised them in the laboratory while they worked on their individual projects.

Dependent Variable

The dependent variable was the students' achievement of the concepts and terminology related to manufacturing.

The subjects were measured by a questionnaire and posttest developed by the investigator. The questionnaire was administered to the treatment group for immediate feedback response based on a four-point Likert-type scale (Appendix D). The posttest was designed to measure the student's achievement of the behavioral objectives outlined in the teacher's guide (Appendix B).

Instructional Materials

The design, development, and evolution of a manufacturing instructional package was initiated with the establishment of behavioral objectives listed in the front of the "Teacher's Guide" (Appendix A). Based upon these objectives, an instructional package was prepared to include detailed lesson plans, handouts, a predetermined product, jigs and fixtures, hand tools, portable electric tools, and a slide-tape presentation. The materials were developed with the concept that any industrial arts teacher could clearly conduct the unit of study without any type of in-service workshop or pre-demonstration of the materials. The ultimate goal was to make the instructional unit available to local industrial arts programs. Requests to use the instructional package would be coordinated through the Wagner Resource Center at the Industrial Technology Department, University of Northern Iowa.

The instructional unit entitled "The Enterprise System" was designed to be implemented in seven separate lessons. The lessons were developed from behavioral objectives listed at the beginning of each lesson. The objectives are followed by a suggested time schedule, list of equipment and materials needed, and a reference text, The World of Manufacturing (1971). The text was intended to assist the teacher in preparing for the presentations outlined in the teacher's guide. There were special notes to the teacher to help guide him or her through the implementation of each lesson as well as the entire instructional unit.

The instructional package was developed with an activity oriented approach. Special consideration was given to the selection and development of the mass production activity. The predetermined product was designed to provide the students with a number of production processes to organize and place in a logical sequence.

The jigs and fixtures that accompany the instructional unit were designed to perform the various operations accurately and with consideration for the junior high school students' abilities. Since this unit was intended to be mailed from the University of Northern Iowa, hand tools and portable electric tools were purchased to correlate with the jigs and fixtures; thus allowing the implementation of the entire instructional unit to be adaptable to any industrial arts facility.

The laboratory activities consisted of planning production, developing a flow process chart, arranging the jigs and fixtures, producing the product, finsihing, assembling, and packaging the product. The product, a tic-tac-toe board, consisted of two components. The students organized two production lines and produced each component. The base component was manufactured from soft wood that was pre-cut by the teacher to specifications determined by a working drawing. The first operation performed was chamfering, as illustrated in Figure I. This was accomplished with a jig to hold the work piece and guide the hand plane. Figure II shows the use of a jig and backsaw to perform the second operation that cut the game pattern on the base. Figure III demonstrates the drilling operation that was accomplished with the aid of a light-duty Craftman's drill press. The block of wood was placed in the fixture tightly against the fence as shown in Figure IV. The depth stop was pre-set during the drilling of the hole pattern. It made no difference where the base was located. As long as it was within the wooden fence, the hole would be drilled in the correct location. With the aid of these jigs and fixtures, the bases were produced and then advanced to the finishing room to receive a penetrating oil finish.

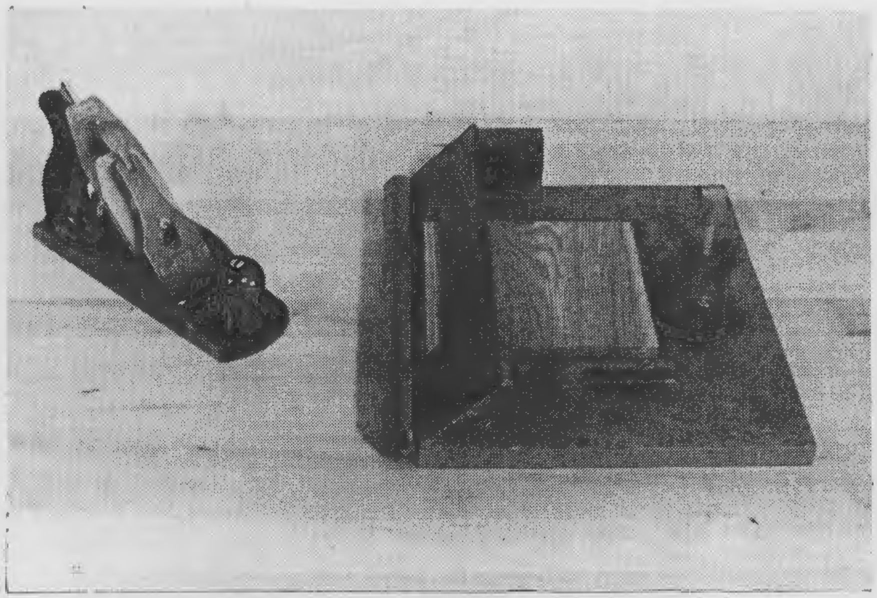

Figure I. The production worker used this hand plane and jig to perform the chamfering operation.

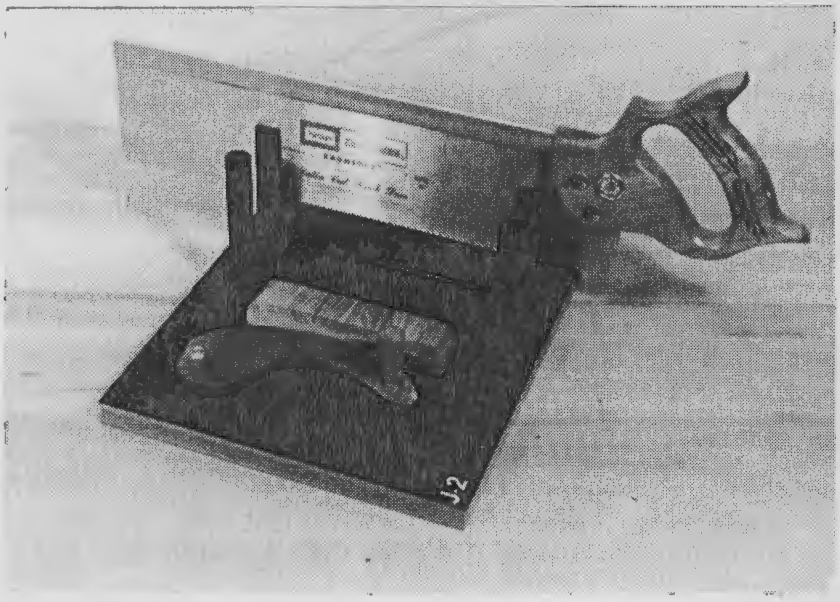

Figure II. The game pattern was cut into the pre-sized component using this special jig and backsaw.

Figure III. A light-duty Craftsman drill press was used to perform the drilling operations. Safety guards were also installed to protect the operator (arrow).

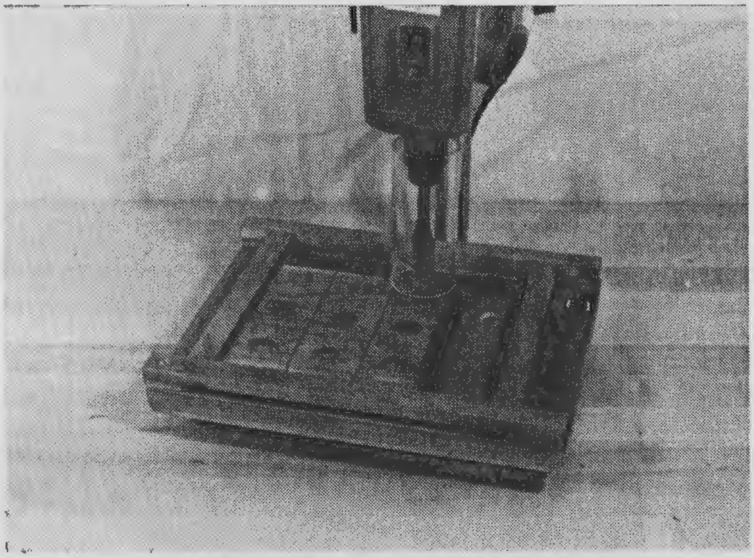

Figure IV. The operator drilled the hole pattern by moving the base component along the wooden fence.

The second production line related to the pegs that made-up the second component. They were produced from standard 3/4 inch wood dowels. The first operation involved cutting the stock to length using a jig and backsaw as shown in Figure V. The pegs were then sanded to dimension using the sanding disc illustrated in Figure VI. The next two operations included drilling and sawing the descriptive patterns on each end of the pegs. Figures VII and VIII illustrate the jig and fixture used to perform these operations. When enough components were produced, they received a penetrating oil finish and were ready for assembling. Figure IX shows the assembling and packaging performed on each product. The completed products were distributed to the members of the class.

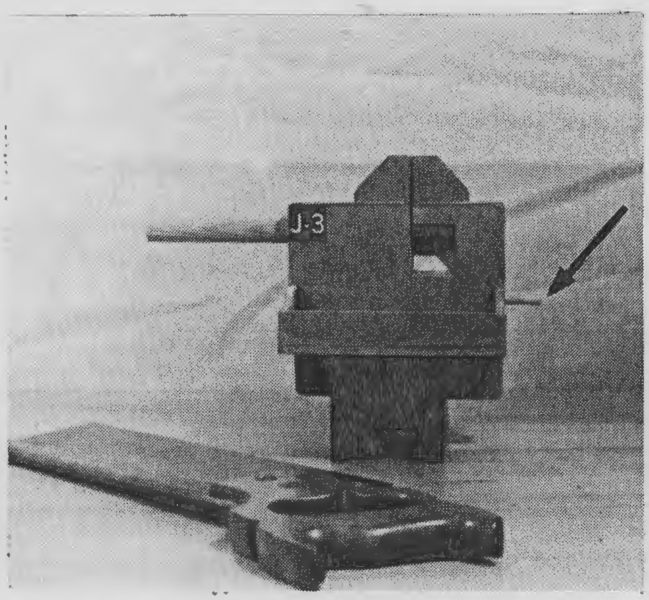

Figure V. This jig and backsaw were used to saw the dowel rods to the proper length. If the part became lodged in the jig, the operator used the ejection pin located at the right side of the jig (arrow).

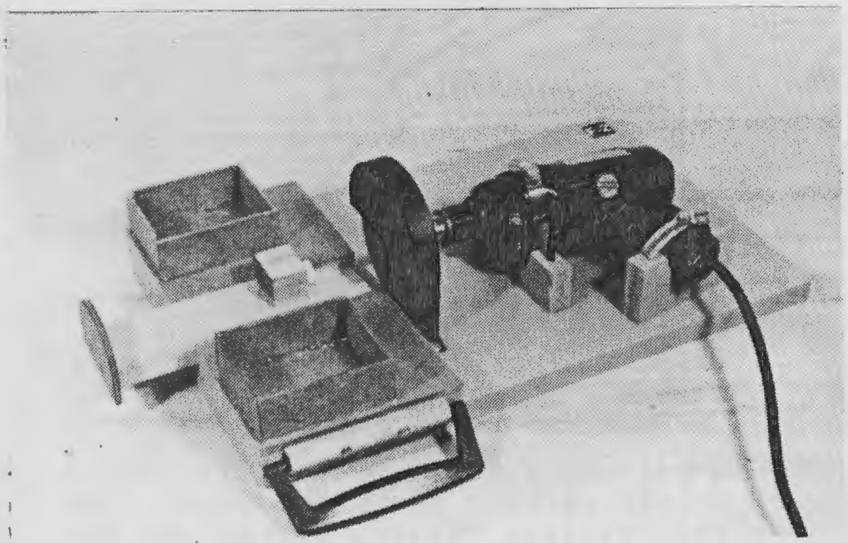

Figure VI. This sanding disc was used to size the pegs to the tolerable dimension.

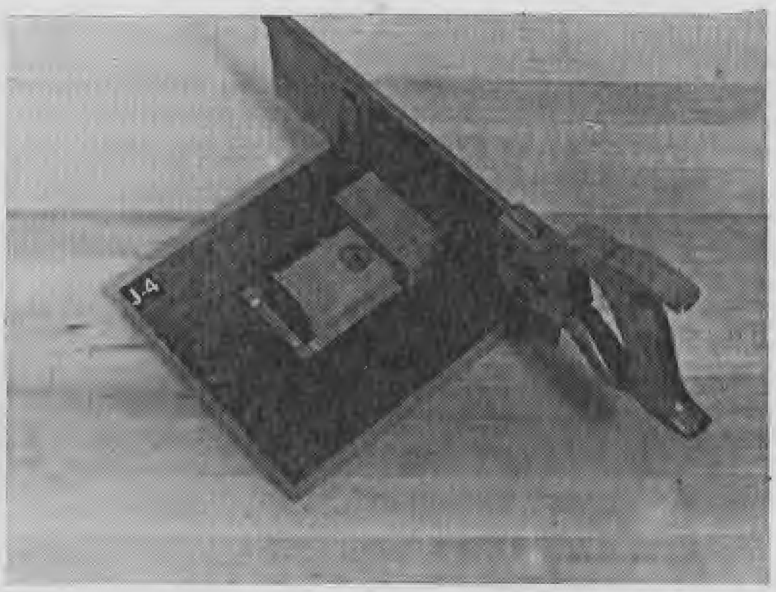

Figure VII. This jig was used with a backsaw, to cut the descriptive saw kerfs in one end of each peg.

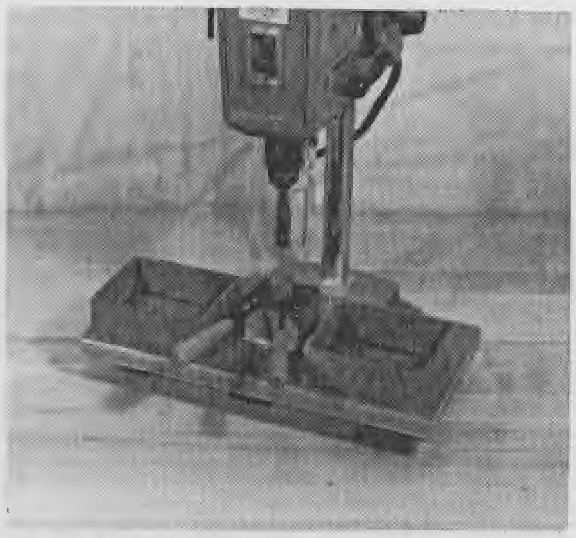

Figure VIII. The fixture mounted on this drill press was used to locate the peg in the correct position while the descriptive mark was drilled on the opposite end of each peg.

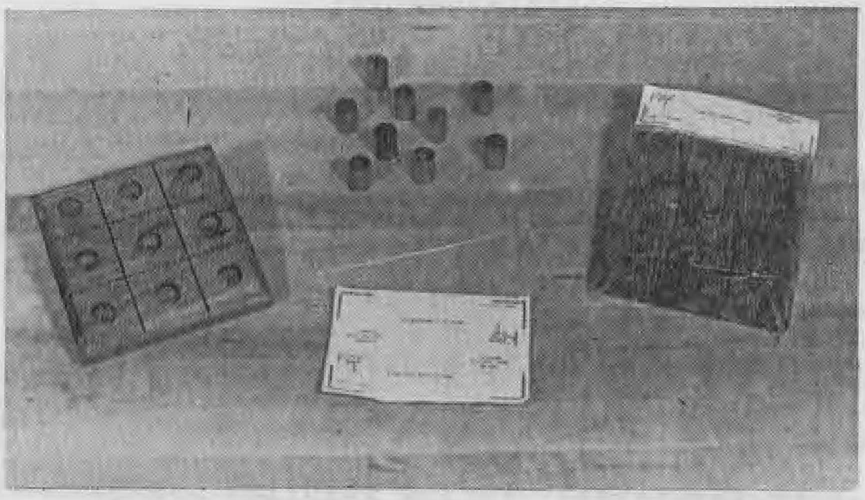

Figure IX. The products were packaged using simple sandwich bags and duplicated labels.

The rationale for the prepared packaged materials was that the teacher, with minimal efforts and preparation, would successfully implement a unit of study relevant to our technological society. The students would achieve, through active participation, a better understanding of how our technological society functions. The value of a mass production activity developed to the production stage is best expressed by Sredl and Travis (1968), who stated:

> Since the beginning students have, at best, only a vague idea of what industry is all about, it is unrealistic to suppose that they can quickly and successfully plan and produce a product. But if a product is in the production stage, complete with jigs and fixtures, . . . the instructor can quickly show the entire class what happens at each station (p. 44).

INSTRUMENTATION

The instruments used in this investigation pertain to the unit examination and the instructional attitude questionnaire developed by the writer. A committee of experts reviewed the two measures and the necessary revisions were made. The committee consisted of Dr. Douglas T. Pine, Assistant Professor of Industrial Technology, Professor Willis H. Wagner, Resident Author, Department of Industrial Technology, and Dr. Bruce G. Rogers, Associate Professor of Educational Psychology.

Unit Examination

The unit examination (Appendix B), was a comprehensive evaluation consisting of twenty-five multiple choice questions. The questions were developed as criterion measures of the instructional unit's behavioral objectives. A breakdown of the test items is presented in Appendix C, along with the *teacher's answer key. The students were given careful in-*structions and allowed thirty minutes to complete the unit examination.

Instructional Attitude Questionnaire

The instructional attitude questionnaire (Appendix D), was developed to acquire immediate student feedback pertaining to the instructional unit. The questionnaire consisted of eight questions based on a four point Likert-type

Scale and two response questions that enabled the students to provide written suggestions.

Data Collection And Analysis Procedures

The data for this research study was collected at the end of the seven day treatment. An instructional attitude questionnaire, administered first, provided the investigator and cooperating instructor with an overall reaction to the effectiveness of the instructional unit. The student responses were tabulated and a mean score for each response was established. The means were then averaged for an overall response mean.

Following the questionnaire, a twenty-five item unit examination was administered to both groups. The unit examination provided the means with which a t-test statistic was established. The mean score differences provided the basis for accepting or rejecting the research hypothesis. The test score of one student who was absent during the administering of the posttest was not utilized in the analysis of data.

The analysis of data was conducted with the aid of the University of Northern Iowa's Computer Service Department. The test scores were entered into the computer and the means and standard deviations were calculated. The statistical findings were based upon a significance level of .05. The findings of the analysis of data is presented in chapter four.

Chapter Summary

The methods and procedures for this study were directed towards establishing the effectiveness of an innovative approach of instruction. The objective was to provide inexperienced teachers and beginning students with basic concepts and terminology related to manufacturing. The sample consisted of forty-one junior high school industrial arts students who were heterogeneously assigned by computer to the two classes. A post-test control group design was selected to determine the effectiveness of the independent variable (the method of instruction) on the dependent variable of achievement.

The instrument measures were developed, evaluated, and revised prior to administering them to the two groups. The collected data was subjected to a t-test at a significance level of .05 to determine if a significant difference did exist between the two groups.

CHAPTER IV

ANALYSIS OF DATA

Introduction

The purpose of this chapter is to investigate the statistical findings of this research study. The data is based upon the experimental group which received the instructional unit on mass production, compared to the control group which continued to receive the traditional technique of instruction. The analysis of the data is based upon the dependent variable, level of achievement, measured by the posttest administered to the two groups following the completion of the treatment. Data referring to the attitude questionnaire, administered to the experimental group only, is analyzed in this chapter to establish the students' reaction to this method of instruction.

One should note, that the analysis of data is based on a relatively small sample of the population. Obviously, the larger the sample, the broader one can generalize his findings. The investigator in this study was primarily interested in developing the instructional materials and analyzing its effectiveness based on an experimental pilot study. The population was limited to the two groups of industrial arts students at Peet Junior High School in Cedar Falls, Iowa. Therefore, the design is properly designated as quasi-experimental.

Instructional Attitude Questionnaire

The instructional attitude questionnaire was developed to provide valuable data from the students with regard to their feelings towards the instructional unit. The instrument consisted of eight questions based on a four point Likert-type scale and two questions that allowed for student comments. There were no wrong answers. The students were asked to simply circle the appropriate answer that described their honest opinion of the manufacturing unit of study. The questions were positvely stated with the intentions of directing student responses towards certain aspects of the instructional unit. The investigator was interested in establishing an average response for each question as well as an overall response to the manufacturing unit.

The procedure for scoring each questionnaire consisted of assigning each response a specific number. The response, stongly disagree, was assigned a one, and the numbering continued through strongly agree which was assigned a number four. The first eight questions were tabulated and scored using an interactive computer. The last two questions were visually inspected for valuable student suggestions.

The interactive computer calculated the means and standard deviations for each variable, the findings are presented in Table 3. In order to further examine these means, a frequency distribution was tabulated and an overall response mean of 2.92 was calculated. This indicated that the students tended to agree with the instructional approach to which they were exposed.

The two questionnaire items that reflected the most interest were items two and eight. These two questions were written to determine if the students enjoyed the actual product and if they enjoyed the group participation of mass producing the product. Ten out of eighteen students agreed, the other eight strongly agreed that the product was enjoyable and fun to make. The students' reactions to the group project approach indicated that eight agreed and ten strongly agreed.

The lowest mean (2.38), was tabulated from item six of the questionnaire. The students indicated that they were not interested in designing and constructing the jigs and fixtures used in mass production.

Items nine and ten were analyzed through inspection of each student's written suggestion. The responses for improving the lectures and discussions indicated that eight students suggested more time be directed on discussing the production procedures, four suggested that no improvement was needed, and the other six students commented on other aspects of the instructional unit. Item ten asked for suggestions for improving the actual mass production activity. Six students suggested that additional jigs and fixtures

TABLE 3
FREQUENCY DISTRIBUTION OF
INSTRUCTIONAL ATTITUDE QUESTIONNAIRE
TABULATED RESPONSES

ITEM NUMBER	1 SD	2 D	3 A	4 SA	RESPONSE MEAN	SD
1	1	5	12	0	2.61	.60
2	0	0	10	8	3.44	.51
3	1	2	11	4	3.00	.76
4	0	9	4	5	2.77	.87
5	0	4	13	1	2.83	.51
6	4	5	7	2	2.38	.97
7	0	3	15	0	2.83	.38
8	0	0	8	10	3.55	.51
TOTAL					23.41	5.11
OVERALL RESPONSE MEAN					2.92	.64

should be constructed, five students indicated that more time should be spent on organizing the production activity, three students thought the activity needed no improvement, and the other four students commented on other aspects pertaining to the activity.

Achievement on Unit Examination

The posttest developed to measure the students' achievement of concepts and terminology related to manufacturing, consisted of a twenty-five item, multiple choice examination. A total of forty students completed the unit examination. One student who was absent during the evaluation period was given a make-up examination. However, his test score was not included in the analysis of data.

The findings of this study, summarized in Table 4, shows a mean score for the experimental group of 17.31, compared to the control group of 13.00. This yields a t-value of 3.5, with 38 degrees of freedom, which is significant at the .01 level; thus adding confirmation to the research hypothesis.

However, due to the geographical limitations, the ability to generalize the findings is limited. The data does, however, indicate that further research with this type of innovative approach is warranted.

TABLE 4
MEANS AND STANDARD DEVIATIONS OF
STUDENT'S ACHIEVEMENT ON UNIT EXAMINATION

GROUP	N	$\overline{X}$	SD	t
EXPERIMENTAL	19	17.31	3.84	
				3.5
CONTROL	21	13.00	3.91	

Chapter Summary

This chapter described the statistical findings of the experiment. A comparison between the experimental group which received the instructional unit and the control group which continued the traditional technique was made in terms of a unit examination which measured the students' achievement of selected objectives. In addition to the unit examination, an attitude questionnaire was administered to the experimental group to determine if they tended to agree or disagree with this method of instruction.

The findings of the instructional attitude questionnaire indicated that the students generally agreed with this approach to learning the concepts and terminology related to manufacturing. In regards to the unit examination, the mean scores of the experimental group compared to the control group, did achieve a significant difference at the .01 level.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This chapter presents a summary of the research study. Conclusions based upon the analysis of data are presented along with recommendations to the educator and to the researcher.

SUMMARY

The Problem

Innovative programs have contributed greatly to the field of industrial arts education. They have provided excellent instructional materials with which to implement the recommended program. Yet, for one reason or another, many of these programs have not been widely utilized by industrial arts educators. Either the teacher is unfamiliar with implementing manufacturing curriculums or he/she lacks the facilities with which to effectively offer a relevant curriculum that possesses manufacturing concepts.

Therefore, if an introductory unit on manufacturing concepts and terminology relating to industry were presented to junior high school students, would there be a significant difference in the achievement of the selected objectives, when students are taught by the mass productive technique as opposed to the traditional technique? Secondly, would a mass production project aid in the students' understanding of the concepts and terminology related to our modern day industries? The answers to these questions provided the primary impetus for this research study.

Review of Related Literature

Industrial arts education has been in a constant state of modification since it was first introduced in the public schools of the United States. The emphasis was to make education relevant. According to Cochran (1970), industrial education should be relevant in content, teaching methods, and in its relationship to the technological society.

The concern generated for curriculum relevancy has resulted in the development of several innovative programs. The objective of these programs is to update existing industrial arts curriculums in order to focus upon technological advancements appropriate to our industrial society. If industrial arts educators do not wish to adjust their curriculum to accept one of the innovative programs, they may incorporate key concepts offered by these programs, or design one that is appropriate for their existing curriculum. Another alternative is to administer a introductory unit that will provide basic concepts relevant to manufacturing. This instructional unit was designed to offer the instructor an activity oriented approach that would guide him in implementing a successful manufacturing unit of study. It was the writer's intent that upon completion of this unit, the instructor would venture toward a more in-depth program such as one present in the review of literature.

Methods and Procedures

Sample Description. The population for this study consisted of junior high school industrial arts students at Peet Junior High School, in Cedar Falls, Iowa. Due to the inability to randomly assign the subjects, two intact eighth grade classes were utilized. Each class was heterogeneously grouped by a computer with a total of twenty students in the experimental group and twenty-one students in the control group. Therefore, it was assumed that the two groups were closely comparable and were not grouped according to ability, sex, or any other criteria.

Research Design. A quasi-experimental design employing a post-test only control group was selected since randomization of the subjects was not possible. A posttest was administered to both groups to determine the effects of the independent variable (method of instruction) on the dependent variable of achievement. The test score means were compared using a t-test to determine if a significant difference did occur based on the .05 level.

Instructional Materials. The instructional unit, based upon behavioral objectives, was prepared to include detailed lesson plans, handouts, predetermined product, jigs and fixtures, hand tools, portable electric tools, and a slide-tape presentation. The materials were developed with the concept that any industrial arts teacher could easily conduct the unit of study without any type of in-service workshop or pre-demonstration of the materials.

The instructional unit entitled, "The Enterprise System", is designed with an activity oriented approach. Special consideration was given to the selection and development of the mass production project in order to provide the students with hands-on activities. The primary objective for this approach was to provide for inexperienced teachers and beginning students a basic introductory unit on concepts and terminology related to manufacturing.

Instrumentation. The students attitude towards the introductory unit of study was measured by a ten item questionnaire. The first eight questions, based on a four point scale of strongly disagree to strongly agree, determined the students overall response towards the instructional unit. The last two questions permitted the students to write-out suggestions pertaining to key aspects of the unit.

A second instrument, developed to measure the students' achievement of the concepts and terminology relating to manufacturing, consisted of a twenty-five item unit examination. The multiple choice questions were designed as criterion measures of behavioral objectives for the instructional unit.

Data Analysis

The data for this investigation was collected at the end of the seven day treatment. The instructional attitude questionnaire, administered first, established an overall mean of 2.92. This indicated that the experimental group generally agreed with the method of instruction.

The unit examination measured the effect of the independent variable on the dependent variable. The mean difference between the experimental group and the control group did achieve significance at the .01 level. Therefore, the results were consistent with the research hypothesis.

CONCLUSIONS

The conclusions drawn from this research study, based upon the analysis of data, established the criteria to warrant further investigation with this type of innovative approach.

Instructional Attitude Questionnaire

The results, based upon the attitude questionnaire, contributed the following conclusions:

1. The students generally agreed with the content of the introductory unit of study.
2. The students strongly agreed with participating in a group activity.
3. The students were not interested in designing and fabricating jigs or fixtures. It was likely that

the students had less interest in design activities simply because they had not been exposed to mass production type experiences.

4. The majority of students suggested that more time should be centered on the discussion of the production procedures.

5. The majority of students also suggested that additional jigs and fixtures should be constructed to aid in the production of the product.

Unit Examination

The student's level of achievement related to this instructional unit of study, enabled the investigator to draw the following conclusion:

1. The instructional unit does, at a significant level, contribute to the student's understanding of the concepts and terminology related to manufacturing.

RECOMMENDATIONS

Recommendations to the Educator

Innovative programs have proven to effectively provide students with skills and learning experiences that pertain to our rapid developing technological society. The following recommendations to the educator are the opinion of the author of this study.

1. In the process of updating industrial arts curri-

culums, educators should give serious consideration to the various innovative programs offered by recognized institutions.

2. The lack of facilities or personal knowledge should not prohibit industrial arts educators from providing effective and efficient instruction on concepts relevant to manufacturing.
3. Industrial arts educators who are unfamiliar with manufacturing concepts, should seek instructional units such as this one to help them develop the basic concepts relevant to manufacturing.
4. Once the industrial arts educator has been exposed to the basic concepts, it is recommended that he/she develop a more in-depth program related to manufacturing.

Recommendations to the Researcher

As a result of the encouraging findings of this study, it is suggested that further investigation with this instructional material would be of value in extending the present data base. To assist the researcher, if a follow-up of this study were conducted, the following recommendations are suggested:

1. The percentage of time that students spend planning their production activity amounts to fourteen percent of the total instructional time. This content of the instructional unit is important and should be

expanded.

2. To accomplish the first recommendation, the researcher will need to evaluate the suggested time schedule and possibly include additional instruction time to accommodate this task.

3. The researcher desiring to conduct a follow-up to this study should make every effort to employ a true experimental design; one that enables him to achieve complete randomization of the sample.

4. A similar study of this nature should be expanded to include a larger sample from which to generalize ones findings.

5. The researcher should develop a replication of the disc sanding fixture. This would help to balance the line production.

6. An achievement instrument with additional items should be constructed to provide a more comprehensive measure of each behavioral objective.

7. The writer would like to recommend that the next researcher give consideration to developing additional mass production activities that would be interchangeable with the content of the teacher's guide. In offering a selection of products developed in the production states, the flexibility of the instruction unit would be increased.

8. It is recommended that the researcher replace items four and fifteen on the achievement test to read as follows:

   (4) Certificates which can not be redeemed for a given period of time, but do regularly draw a fixed rate of interest are called: (a. stocks, b. loans, c. industrial bonds, **or** d. notes).

   (15) Production activities such as drilling a 3/4 inch hole using a light duty drill press, cutting stock to length using a saw jig, and chamfering wood using a planing jig are known as: (a. operations, b. processes, c. tooling-up, or d. quality control).

9. It is also recommended that in lesson one of the teacher's guide (Appendix A), review question 6-c should be revised as follows:

   Corporations also raise money by selling bonds. Bond holders receive interest on their loans regularly, but they cannot help elect the board of directors.

Chapter Summary

This chapter presented a brief summary of the investigation, conclusions drawn from the analysis of data, and recommendations to educators and future researchers.

The emphasis placed on this study was to develop and evaluate an instructional unit of study that dealt with basic concepts and terminology related to manufacturing. The objective was to organize the materials into a prepared package that could be made available to industrial arts educators. The primary conclusion reached was that this prepared instructional unit of study did contribute significantly to the students' achievement of the concepts and terminology related to manufacturing. However, due to the limitations of this study, the investigator suggests that future research be conducted to expand and extend the data base from which to draw conclusions.

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APPENDICES

APPENDIX A

TEACHER'S GUIDE

THE ENTERPRISE SYSTEM

TEACHER'S GUIDE

PREPARED BY
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EXPLANATION OF COURSE DESIGN AND INSTRUCTIONAL SYSTEM

The "Enterprise System" is an innovative one week junior high unit in manufacturing technology. Its instructional system is designed to provide students with basic manufacturing concepts and terminology. This educational unit is a complete package that provides the teacher with all necessary materials needed to manipulate the unit of instruction. Included in the package are: a predetermined product to be manufactured, all necessary tools and equipment needed to manufacture that product, a working drawing, flow process chart, related manufacturing terminology handout, teacher's guide, unit objectives, time schedules, presentations, discussion questions, list of materials, and instructional aids needed.

The instructional unit is organized to focus primarily on manufacturing techniques that provide the students with group activities. These activities include:

Lesson one: Discussion of the enterprise system
Lesson two: Production planning, organizing processes, and establishing a flow process chart
Lesson three: Conducting a pilot run and evaluating the production set-up
Lesson four and five: Completing the production run and finishing the parts
Lesson six: Assembling the parts and packaging the products
Lesson seven: Evaluation

The learning experiences are designed to provide the students with a basic understanding of industrial related concepts and terminology associated with enterprise systems. The expected behavioral changes resulting from the instructional unit are listed for each day of the unit.

TO THE TEACHER

This instructional unit has been prepared to assist the teacher in implementing a manufacturing unit of study. The lessons have been prepared in detail to assist the teacher in preparation of the manufacturing presentations for this unit. The teacher will want to prepare each lesson in his own words and present it on the level of the students he is instructing. For this unit to be effective, the teacher will want to inspect the instructional unit to insure that all instructional materials are present. He will also want to familiarize himself with the operations of the jigs and fixtures to assure that they are in proper alignment and complete working order. An extra day has been provided to allow for unanticipated interruptions and incompleted lessons or lab activities. It is surmised that the actual production run may take more than one class period depending upon the size of the class. This teacher's guide is designed to remain flexible. The teacher will want to complete each lesson as thorough as he desires and manufacture enough products to ensure that each student has one.

TEXTBOOK

In order to further assist the teacher in preparing the presentations for this unit, the textbook, The World of Manufacturing (1971), McKnight Publishing Company, is provided with this instructional package. Numerous expert consultants contributed to this text to provide the teacher with a conceptual framework for understanding manufacturing technology.

UNIT OBJECTIVES

As a result of their learning experiences, this unit will enable the students to do the following:

1. distinguish correctly how enterprises relate to industry.

2. identify the necessary elements that make-up an enterprise.

3. identify the role of management and communications necessary for planning production systems.

4. identify key industrial terminology related to manufacturing.

5. organize and write out a schedule placing the required processes and operations in proper sequence.

6. develop knowledge and manipulative skills in performing each individual job.

7. identify the importance and need for performing each individual job.

8. mass produce enough components so that when they are combined there will be enough products for each student to have one.

9. perform a given job safely, accurately and within the set standards.

10. identify three major factors to consider and plan out in packaging a product.

11. completely package and label their finished product.

12. identify procedures and terminology used in liquidating an enterprise.

LESSON ONE

Introduction to the Enterprise System

BEHAVIORAL OBJECTIVES

As a result of their learning experiences, the students should be able to do the following:

1. Given four sets of elements, correctly identify the three major elements that make up an enterprise.

2. Correctly identify, from a given selection of answers, the ones that best describe internal and external communications.

3. Given descriptions of methods commonly used to finance enterprises, correctly distinguish between bank loans, stocks, and bonds.

4. Given the four systems elements, correctly arrange them in their proper order.

SUGGESTED TIME SCHEDULE

5 min. - Introduction
15 min. - Slide Presentation
20 min. - Discussion of Enterprise
10 min. - Introduction of Product (Handout 1-A)

EQUIPMENT AND MATERIALS

1 - slide projector and screen
1 - slide series "The Enterprise System" and narrator's guide
1 - completed sample product and working drawing, 1-A

INTRODUCTION

1. Today we want to look at enterprises, and how they relate to industry.

2. After we view this slide presentation we will discuss the elements that make up an enterprise and how the demands of the consumer are met.

3. You will want to pay close attention to those elements that make up an enterprise, because we will be organizing and producing a product much the same as an enterprise does.

4. It may be helpful to take notes or write down questions you might have, concerning the enterprise system.

PRESENTATION

1. This slide presentation is entitled "The Enterprise System".

Note: Tell the students to pay close attention to the elements that make up an enterprise. Follow the narrator's guide that accompanies the slide series in order to advance the slides in sequence.

REVIEW

1. What is an enterprise? (Students should be able to cite several examples.)

    a. Car dealership that offers a means of transportation.

    b. Hobby shop that fulfills our creative yearnings

    c. Food enterprises that supply a very demanding need

    d. Beverage enterprises, Coca Cola, Seven Up, Pepsi Cola, etc., that fulfill our thirsts

    e. Public services, which help solve social, medical and security problems.

2. How do enterprises relate to industry? (Students should again be able to cite an example.) Industry is made-up of many related enterprises such as: In the automobile industry, the parts that make up an automobile come from many different enterprises.

3. What are the three major elements that comprise an enterprise?

    a. Coordinating

    b. Resource elements

    c. Systems elements

4. Coordinating elements consist of management and communications. What responsibilities does management have?

    a. Management takes care of coordinating the activities within the company.

    b. Management tries to ensure smooth and accurate production of goods and services.

    c. People in management make the decisions determining the goals of the company and how they are to be met.

5. What are the two types of communications within the enterprise?

    a. Internal communications which take place between individuals within the enterprise. Examples are the telephone, intercom systems, office memos, etc.

    b. External communications which consist of messages between an enterprise and elements outside the enterprise. Examples are advertising, television, magazines, newspapers, billboards, etc.

    c. Communications are a vital element in an enterprise system. How many students have bought a product because they saw it on television or in a magazine? This should emphasize the importance of communications.

6. Another vital element of the enterprise is finances. How does the enterprise obtain money to purchase materials and pay the people's salaries who work for them?

    a. Raise money through the sale of stock in the company. Stock holders are considered part owners of the company and receive a share of the profits.

    b. Bank loan.

    *c. Bond sales, they are much like savings accounts. People who believe the company will continue to profit yearly, will purchase bonds. Example, a bond that is purchased for $37.50 will provide the holder with a $50.00 return when held for a 5 year period. *(Refer to recommendation number eight)

7. What other elements can you think of that are important within an enterprise system?

    a. Human resources, the skilled workers are the back bone of any company.

b. Energy and natural resources are also a vital aspect of the enterprise.

8. The third major element of an enterprise is the "Systems Elements." What elements make up the enterprise's systems?

   a. R and D, research and development, which identify new and better products that help the company to stay ahead.

   b. Production, which develops the assembly procedures for producing the product.

   c. Marketing department, which determines the units to be produced, and the kinds of products that appeal to the consumer.

   d. Distribution department, which determines where the products are to be sent and how they are to be transported.

   e. Maintenance and Service departments, which guarantees quality performance and offer services to maintain product performance in the field.

INTRODUCTION OF CLASS PRODUCT TO BE MANUFACTURED

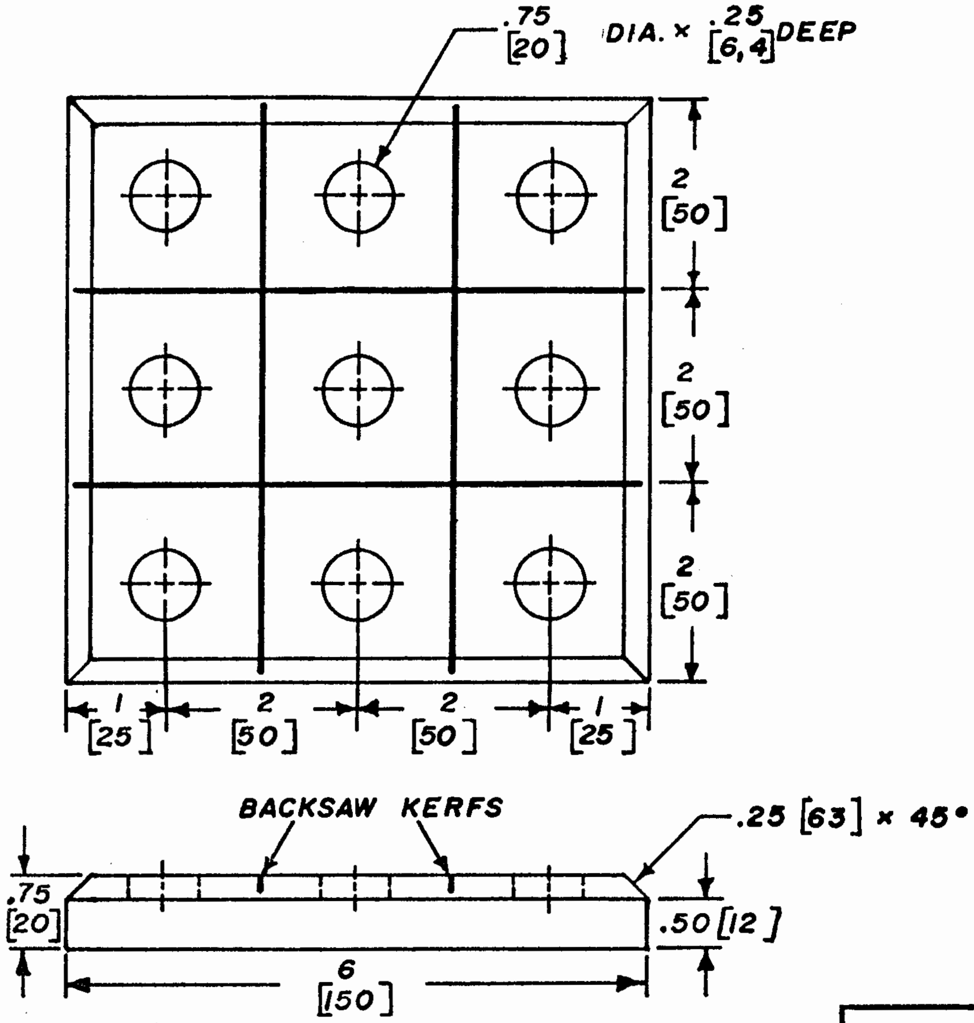
1. As a class, we want to use the knowledge we have gained from the slides and discussion of the enterprise system to produce a product of our own.

2. We will not organize a company, rather we will focus on the manufacturing aspects of the product using production procedures similar to an enterprise.

3. The product to be mass produced is this. (The teacher will show the product and briefly explain the processes used in producing the product. The teacher should explain the types of materials used, the type of finish, and the design of the packaging and label for the product. Handout the Working Drawing, one per student.)

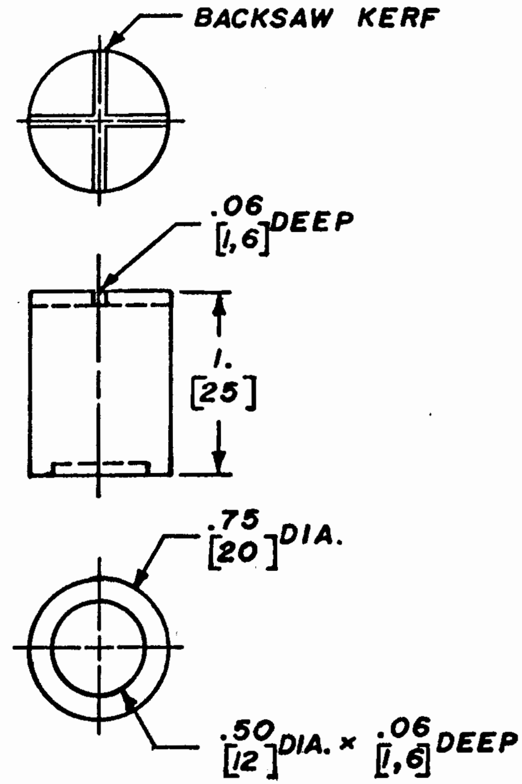
4. During the next class meeting, we will organize the necessary processes and look at the methods to be used to produce our product.

Note: If time permits, the teacher might encourage the students to elect an enterprise title of their own. If students wish to do so, they should bring to the next class meeting their designs for their product label.



BASE

HALF SIZE



PEGS

FULL SIZE

(DIMENSIONS IN BRACKETS ARE MILLIMETERS)

TIC-TAC-TOE		
SCALE:	APPROVED BY:	DRAWN BY J.K.M.
DATE: SPRING '77		REVISED
KING-TOY ENTERPRISE		
		DRAWING NUMBER

LESSON TWO

Planning Production

BEHAVIORAL OBJECTIVES

As a result of their learning experiences, the students should be able to do the following:
Given information on planning production processes:

1. Correctly identify, from multiple choice items, the industrial position that best fits the job description.

2. Develop a process chart by correctly identifying and listing a set of required processes in the proper sequence.

3. Correctly identify, from a list of manufacturing terms the key term that best fits the definition.

SUGGESTED TIME SCHEDULE

- Complete discussion on lesson one, if necessary
5 min. - Review and Overview
30 min. - Presentation
15 min. - Lab Activity

EQUIPMENT AND MATERIALS

1 - overhead projector and screen or chalkboard
1 - (per student) flow process chart 1-B
1 - (per student) manufacturing terminology 1-C
1 - (per student) flow chart 1-D
1 - sample product

REFERENCES

Lux, D. G. and Ray, W. E. The World of Manufacturing (4th ed.). McKnight and McKnight Publishing Company, 1971.

1. Planning Production pp. 116-120
2. Planning Processes pp. 122-127; 461-464; 469-470
3. Tooling Up for Production pp. 146-150

REVIEW

1. At our last session, we dealt with how enterprises relate to industry.

2. We saw the slide presentation on "The Enterprise System", and we discussed the various systems that are involved within an enterprise in order to produce a product or provide a service for the consumers.

3. We also have selected a product that we, as a classroom enterprise, want to manufacture and distribute to consumers.

OVERVIEW

1. Today, we will plan the production system, become familiar with manufacturing terminology and develop what is known as a flow process chart.

2. We will also set-up the laboratory, much like an enterprise, by arranging the jigs and fixtures necessary to produce the product as shown on the flow process chart.

PRESENTATION

Production planning is essential before efficient manufacturing can take place. Tools and machines must be provided. There must be a well organized plan for assigning people to production tasks.

1. First, a "production planner" has to determine how a product can be made. He decides what processes the materials must go through, and in what order these processes must take place. For example, the product will be coated with an oil finish. The finish must be applied before we assemble the product but not before all operations have been completed.

2. With the number of processes involved in our product, we could not possibly complete a production run without developing an organized plan of production. Still more important we could not work together effectively without a plan that we could all read and understand.

3. The easiest way to formulate a production plan is to make a "flow process chart". At this stage you are production planners. You can easily determine what major components are included in the product.

Note: Hand-out number 1-B flow process chart, one per student. It would also be helpful at this point, to show the sample product to the class and use it to point out the different operations. List the components on the overhead projector or chalkboard. Have students identify the operations of each component. As you write the operations on the projector or chalkboard, have the students write the operations on their process charts. Use the sample process chart in the teacher's guide for a reference.

Let's list the components of the product. (Students do not need to write the components on their process chart.)

a. Base
b. Pegs

4. All components are manufactured by processes that have to take place in a definite order. The materials flow from work station to work station along a planned route. Just as you would use a road map in driving drom New York to California. You can use a flow process chart to find what route a workpiece must take as it is being processed.

5. As you fill-out the flow process chart, consider and establish the points where the operations should be inspected for flaws or poor workmanship. If a part is of poor quality, it must be rejected from the good parts. This is referred to as "Quality Control".

6. With these two factors in mind, a definite order and quality, let's complete our process charts by listing the operations required for each component. (Complete the flow process chart, discussing the operations and using the sample chart as a guide.)

7. Now, notice the symbols in the center column of your chart. These symbols represent the map or flow of materials. The map is completed by simply connecting the appropriate symbol with a neat, straight line. (Teacher should note the symbols and their correct meaning.)

8. In summary, the flow process chart is the master plan for production. It lists all processes that take place during production. These processes may include forming, separating, combining, inspecting, and transporting the product.

9. Let's review the terminology related to the manufacturing of our product. (Handout number 1-c, Manufacturing Terminology.)

a. Production planners: Production planners are the people in charge of planning every process to be done in the production line. They must make sure that the materials come into the plant, move through it, and come out as finished products in the best possible way (Lux and Ray, 1971, p. 461).

b. Flow Process Chart: The flow process chart tells how materials and parts will be moved from one process to the next (Amrine, et.al., 1975, p. 120).

c. Flow Chart: Shows where each process will take place. It tells what tools and machines should be used. It shows the movement of raw materials, partly finished parts, and finished products (Lux and Ray, 1971, p. 464).

d. Quality Control: Quality control makes sure that the product, at all times, meets the set standards. This is accomplished through established inspection stations throughout the production lines (Lux and Ray, 1971, p. 466).

e. Components: Components are single parts of a product that are processed and then assembled or combined to form a completed product (Lux and Ray, 1971, p. 254).

f. Operations: An operation involves all of the work performed on the part or parts at one location. An operation tells you what needs to be done and is usually always put into a sequence (order) or steps (Lux and Ray, 1971, p. 122).

g. Processes: Processes are an organized set of operations. Processes that may be used in making a product include: forming, separating, drilling, sanding, finishing, and combining. A process tells you how to perform an operation (Lux and Ray, 1971, p. 122).

h. Materials Handling: Materials handling is the moving, packing, and storing of substances in any form (Lux and Ray, 1971, p. 256; Amrine, et. al., 1975, p. 162).

i. Assembling: Assembling or combining is the order in which the finished parts are put together to form a completed product (Lux and Ray, 1971, p. 463).

j. Tooling-up: Tooling-up is a term that refers to designing and fabricating special equipment or attachments that are needed for production (Lux and Ray, 1971, p. 146).

k. Jig: A jig is a device that holds a work-piece and also guides the tool (Lux and Ray, 1971, p. 146).

1. <u>Fixture</u>: A fixture is a device that holds the workpiece tightly in the right location (Lux and Ray, 1971, p. 147).

LAB ACTIVITY

1. For the remainder of the class session, we want to look at the jigs and fixtures, determine the operations they perform, and arrange them in the proper order we have listed on the flow process chart.

Note: This is a good opportunity to show the students the difference in a jig and fixture and briefly explain the operation each one performs. The emphasis is on using their flow process charts to arrange or map-out their production set-up. Also the flow chart may be introduced at this time, handout number 1-D.

FLOW PROCESS CHART

Summary		Present	Proposed	Saved
OPERATION	○	14		
TRANSPORTATION	⇨	4		
INSPECTION	□	4		
STORAGE	▽	0		
DELAY	D	0		
TOTAL ELEMENTS		22		
TOTAL DISTANCE				
TOTAL TIME				

CHART No. 1 - B

Page 1 of 1

Dept. Production

Process Production of Tic-Tac-Toe Boa

Subject Charted:

Date: Spring '77 Charted by: J.K.M.

ELEMENT NO.	ELEMENT DESCRIPTION (PRESENT / PROPOSED)	OPERATION / TRANSPORT / INSPECTION / DELAY / STORAGE	DISTANCE	TIME	Possibilities: ELIMINATE	COMBINE	CHANGE: Sequence	Place	Person	IMPROVE	NOTES
01	Chamfer all edges	○									Jig: J-1
02	Cut pattern on face of stock	○									Jig: J-2
03	Drill holes on face of stock	○									Fixture: F-1
04	Inspect	□									Check alignment
05	Sand base	○									Sanding block 15
06	Inspect	□									Check end grain
07	Transport to finish room	⇨									
08	Apply oil finish	○									Use cloth rags
09	Transport to drying area	⇨									
01	Cut dowels to length	○									Jig: J-3
02	Sand pegs to dimension	○									Fixture: F-2
03	Inspect	□									Snap gauge
04	Cut pattern on one end of peg	○									Jig: J-4
05	Drill pattern on opp. end of peg	○									Fixture: F-3
06	Deburr pegs by sanding	○									150-c Alum. Oxic
07	Inspect	□									Visual inspectic
08	Transport to finishing room	⇨									
09	Apply oil finish	○									Use cloth rags
10	Transport to drying area	⇨									
01	Final inspection of parts	○									Check finish qua
02	Assemble all parts	○									
03	Package and label all products	○									

FLOW PROCESS CHART

Summary		Present	Proposed	Saved
OPERATION	○			
TRANSPORTATION	⇨			
INSPECTION	□			
STORAGE	▽			
DELAY	D			
TOTAL ELEMENTS				
TOTAL DISTANCE				
TOTAL TIME				

CHART No. 1-B

Page ______ of ______

Dept. ______

Process ______

______ Subject Charted: ______

Date: ______ Charted by: ______

ELEMENT NO.	ELEMENT DESCRIPTION (PRESENT / PROPOSED)	OPERATION / TRANSPORT / INSPECTION / DELAY / STORAGE	DISTANCE	TIME	Possibilities: ELIMINATE	COMBINE	CHANGE: Sequence	CHANGE: Place	CHANGE: Person	IMPROVE	NOTES
		○ ⇨ □ D ▽									
		○ ⇨ □ D ▽									
		○ ⇨ □ D ▽									
		○ ⇨ □ D ▽									
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		○ ⇨ □ D ▽									

MANUFACTURING TERMINOLOGY

1. Production planners: Production planners are the people in charge of planning every process to be done in the production line. They must make sure that the materials come into the plant, move through it, and come out as finished products in the best possible way.

2. Flow Process Chart: The flow process chart tells how materials and parts will be moved from one process to the next.

3. Flow Chart: Shows where each process will take place. It tells what tools and machines should be used. It shows the movement of raw materials, partly finished parts, and finished products.

4. Quality Control: Quality control makes sure that the product, at all times, meets the set standards. This is accomplished through established inspection stations throughout the production lines.

5. Components: Components are single parts of a product that are processed and then assembled or combined to form a completed product.

6. Operations: An operation involves all of the work performed on the part or parts at one location. An operation tells you what needs to be done and is usually always put into a sequence (order) of steps.

7. Processes: Processes are an organized set of operations. Processes that may be used in making a product include: forming, separating, drilling, sanding, finishing, and combining. A process tells you how to perform an operation.

8. Materials Handling: Materials handling is the moving, packing, and storing of substances in any form.

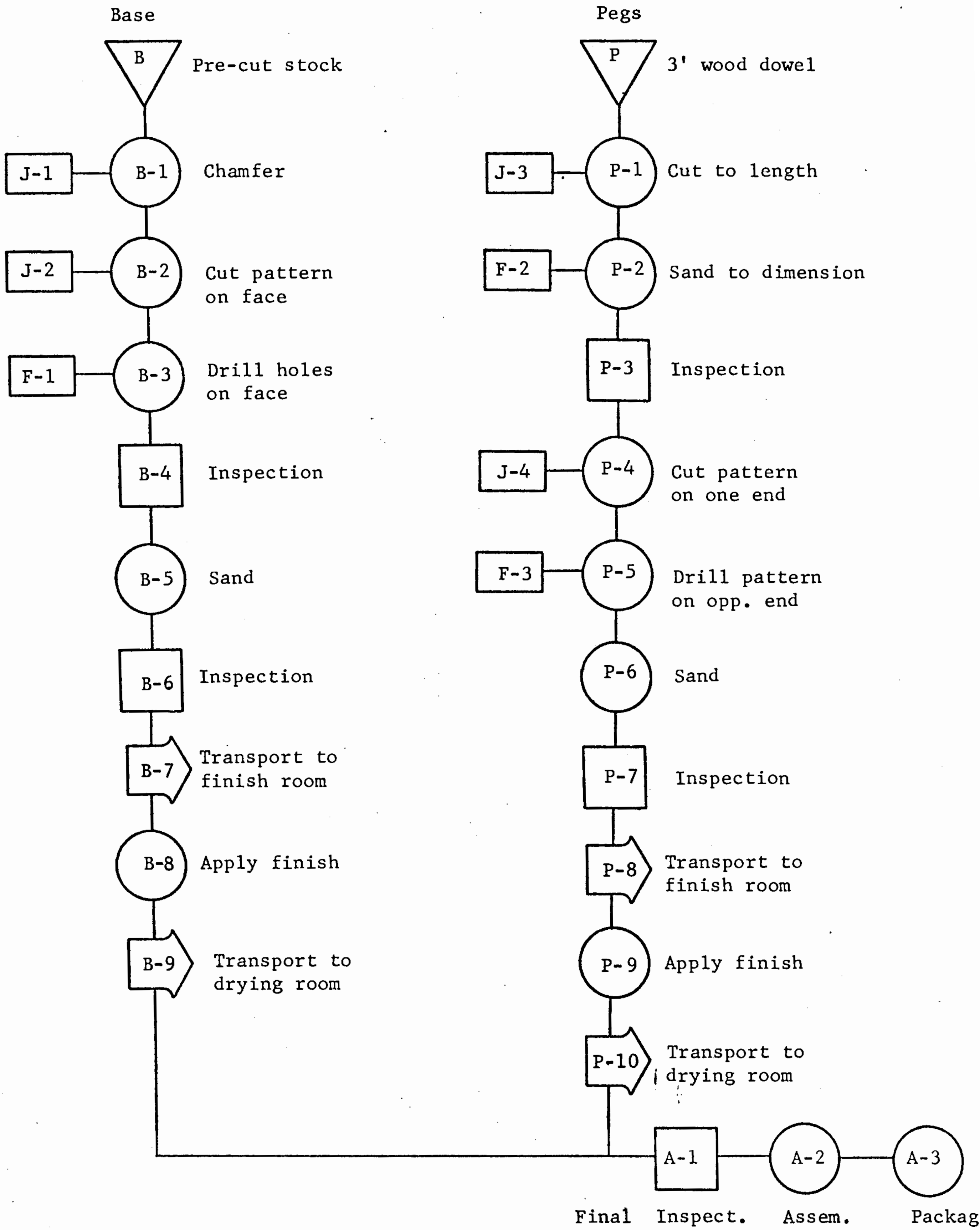
9. Assembling: Assembling or combining is the order in which the finished parts are put together to form a completed product.

10. Tooling-up: Tooling-up is a term that refers to designing and fabricating special equipment or attachments that are needed for production.

11. Jig: A jig is a device that holds a work-piece and also guide the tool.

12. Fixture: A fixture is a device that holds the work-piece tightly in the right location.

FLOW CHART


Base
B
Pre-cut stock
J-1
B-1
Chamfer
J-2
B-2
Cut pattern on face
F-1
B-3
Drill holes on face
B-4
Inspection
B-5
Sand
B-6
Inspection
B-7
Transport to finish room
B-8
Apply finish
B-9
Transport to drying room
Pegs
P
3' wood dowel
J-3
P-1
Cut to length
F-2
P-2
Sand to dimension
P-3
Inspection
J-4
P-4
Cut pattern on one end
F-3
P-5
Drill pattern on opp. end
P-6
Sand
P-7
Inspection
P-8
Transport to finish room
P-9
Apply finish
P-10
Transport to drying room
A-1
A-2
A-3
Final Inspect.
Assem.
Packag

LESSON THREE

Manufacturing Personnel

BEHAVIORAL OBJECTIVES

As a result of their learning experiences, the students should be able to do the following:
Given information on manufacturing personnel:

1. Correctly identify from a selection of answers, the two most important elements an employer looks for in hiring a prospective employee.

2. Develop manipulative skills in performing an individual operation within the set standards of quality.

SUGGESTED TIME SCHEDULE

- Complete lesson two, if necessary
5 min. - Review and Overview
10 min. - Presentation-Demonstration
30 min. - Lab Activity

EQUIPMENT AND MATERIALS

1 - or more 3/4 x 6 x 6 in. Butternut or suitable soft wood
1 - 3/4 x 3 ft. Birch wood dowel
penetrating oil finish
rags
jigs and fixtures
hand tools and portable power tools
sanding blocks and sandpaper 150-C

REFERENCES

Lux, D. G. and Ray, W. E. The World of Manufacturing (4th ed.). McKnight and McKnight Publishing Company, 1971.

1. Manufacturing Personnel Technology pp. 209-213.
2. Hiring and Training pp. 215-219.

REVIEW

1. During the last session we planned the production system and listed the components and operations for our product

2. We established the inspection points, developed a flow process chart, and arranged the jigs and fixtures.

OVERVIEW

1. Today, we want to hire and train workers and conduct a pilot run of the product. Then we will make the necessary changes in our production line, if needed, to eliminate any bottlenecks.

PRESENTATION-DEMONSTRATION

Any company's ability to operate and grow depends on the people it hires and trains. These people must be able to perform certain operations at a set standard or quality of work.

1. First, a company or enterprise tries to hire workers who have an "education" and work experience in industry.

2. When a worker first reports for work, there are formal or informal introduction sessions for him. The supervisor tries to answer the questions he may have. The new worker gets this help until he feels comfortable and secure on his job.

3. The earlier education and training of the new worker gives him the basic skills he needs to start work. Without "basic skills" a worker may not have much chance to get the job in the first place. But no matter how good or complete his schooling or experiences have been, there are bound to be some things he did not learn and now must be trained to perform a new job.

4. In our own enterprise, we have several jobs for which the workers must be trained. Let's take a look at these jobs. (Teacher will describe and demonstrate the operating procedures for each jig and fixture, note the required level of quality, and demonstrate the procedure for applying the finish to the completed parts.)

Note: The teacher may want to assign certain students to perform certain jobs, let the students draw their jobs out of a hat, or elect their own job voluntarily. In any case, the teacher will want to develop the hiring procedure before class session begins. The teacher will also want to become familiar with the jigs and fixtures prior to their demonstration. Due to the shipping of this manufacturing program, certain equipment may need to be realigned in order to perform the job accurately. Make these adjustments before using them.

LAB ACTIVITY

1. Now that we have seen each job and know our own responsibilities, let's see how well trained we are in performing our jobs.

2. What we want to do is conduct a pilot run and see if we can produce one acceptable product.

3. If bottlenecks occur, inspection points need relocating or our workers can not perform their jobs at the set standards, we will need to revise our production plan.

Note: The teacher should closely supervise the pilot run and continue to train individuals in operating the more comlex equipment. If revisions need to be made, stop production and make them.

LESSON FOUR AND FIVE

Production

BEHAVIORAL OBJECTIVES

As a result of their learning experiences, the students should be able to do the following:

Given the necessary equipment and materials:

1. Produce enough components so that when they are combined, there will be enough products for each student to have one.

2. Perform each individual job safely, accurately, and within the set-standards.

SUGGESTED TIME SCHEDULE

- Complete lesson three, if necessary
- 5 min. - Review and Overview
- 45 min. - Lab Activity
- 50 min. - Lesson five, continue lab activity

EQUIPMENT AND MATERIALS

The teacher should prepare enough materials so that each student can take home a completed product. Allow for possible rejects.

(x) - 3/4 x 6 x 6 in. Butternut or suitable soft wood
(x) - 3/4 x 3 ft. Birch wood dowel
penetrating oil finish and rags
trays for material handling
sanding blocks and sandpaper 150-C

REVIEW

1. During the last session, we hired and trained workers.

2. We conducted a pilot run and evaluated our production plan.

3. We determined where quality standards needed improvement and we tried to overcome all bottlenecks.

OVERVIEW

1. Today we are going to make the production run on our product. Remember to do the best job you can, because the parts you make may be your own.

2. Quality control is a vital part of production. The less rejects an enterprise has, the more products it can sell and the more capital it will make.

LAB ACTIVITY

1. The teacher should closely supervise the student's work.

2. The inspectors should allow only acceptable parts to move on through the production line and into the finishing area.

3. The completed parts should be properly finished and stored to dry before they are assembled and packaged.

LESSON SIX

Assembling and Packaging

BEHAVIORAL OBJECTIVES

As a result of their learning experiences, the students should be able to do the following:

Given information on assembling and packaging:

1. Correctly identify from a selection of responses, the best answer or answers that describe a well designed package.

2. Correctly identify from a selection of answers, the three major factors that an enterprise must consider and plan for in assembling and packaging the product.

3. Correctly identify from a selection of answers, the three key terms associated with liquidating a corporation.

SUGGESTED TIME SCHEDULE

- Complete lesson five, if necessary
5 min. - Review and Overview
15 min. - Presentation
20 min. - Lab Activity
10 min. - Follow-up Presentation

EQUIPMENT AND MATERIALS

(x) - large "Baggies" for packaging products
(x) - masters for duplicating labels if one has not been designed and duplicated
(x) - stapler and staples for sealing the packages

REFERENCES

Lux, D. G. and Ray, W. E. _The World of Manufacturing_ (4th ed.). McKnight Publishing Company, 1971.

1. Arranging for Distribution and Sales pp. 478-483.
2. Liquidating the Corporation pp. 484-488.

REVIEW

1. During the last session we manufactured our product and everyone strived to perform their job to the set standard of quality.

OVERVIEW

1. Today we want to complete the production by assembling the components and packaging the products.

2. Packaging is an important part of manufacturing. The product must appeal to the consumer; therefore, several factors must be considered in packaging a product.

PRESENTATION

1. As our product is completed, it must be packaged so it can move from the manufacturer to the consumers.

2. Advertising, selling, and distributing are important factors that an enterprise must consider and which require careful planning.

3. The reputation of a product or "trade name", is important for continued business. Therefore, the manufacturer must provide adequate service for his customers to maintain and improve goodwill and repeat business.

4. Also, for some products, information must be provided so the consumer can intelligently use and care for his product. Usually this is in the form of a service manual or instruction sheet. An example of this is when you go to a hobby craft shop and purchase a model car. What do you always get with model car kits? A set of instructions. It would be difficult to put that model car together properly without the help of instructions. This is a service that the manufacturer provides for the consumer.

5. A well designed package such as ours, is suppose to (1) contain or hold the product, (2) identify the product, (3) protect it from damage, and (4) display the product to the consumer.

6. Let's stop here and proceed to assemble and package our products.

LAB ACTIVITY

1. Neatly lay-out, in proper order, the packaging materials. (The teacher may already have this done before class.)

2. Have a small group of students assembling the components and neatly line the products up on the table.

3. If labels are not prepared, have another small group of students duplicating enough labels for the products. (The teacher may want to bring a spirit duplicator into the classroom if he has access to one.)

4. A third group of students can begin to package the products into the clear baggies and staple labels on them sealing the package.

5. Place the completed products into a box to be distributed at the end of the class session.

FOLLOW-UP PRESENTATION

1. When we first discussed the enterprise system, we talked about forming an enterprise and methods to finance an enterprise

2. Now we have completed manufacturing a product and no longer need to exist as an enterprise.

3. In order to go out-of-business, we have to go through a legal process of settling our company's accounts by dividing our assets, what we possess (land, buildings, tools, and machines).

4. The next step is to settle all debts. This would include the money owed for materials used to make the products. Stockholders would be reimbursed for the amount of money they originally invested plus any dividends (profits) which the enterprise has earned. We then need to sign a legal paper called Articles of Liquidation and our company is dissolved.

5. Once the company is dissolved, we are no longer liable or responsible to service the products we sold to consumers and no one can sue us in a court of law for failure to do so. The enterprise no longer exists.

Note: The teacher can distribute the products to the students as they leave the classroom. He will want to keep one for himself and even give one to the principal. Good luck on your next enterprise.

LESSON SEVEN

Evaluation

BEHAVIORAL OBJECTIVES

As a result of their learning experiences, the students should be able to do the following:

1. React to the instruction attitude questionnaire.

2. Complete an achievement test on manufacturing concepts and terminology with 70% accuracy.

SUGGESTED TIME SCHEDULE

- Complete lesson six, if necessary
5 min. - Preparation for instruction attitude questionnaire
10 min. - Complete instruction attitude questionnaire
5 min. - Preparation for unit examination
30 min. - Complete unit examination

EQUIPMENT AND MATERIALS

1 - (per student) instruction attitude questionnaire
1 - (per student) unit examination

EQUIPMENT ATTITUDE QUESTIONNAIRE

This instruction attitude questionnaire was constructed to give the teacher some immediate feedback as to the student's reaction to certain aspects of this manufacturing unit of study called The Enterprise System. It also gives the student an opportunity to respond and give suggested criticism as to the design of this instructional unit.

1. Read the directions to the students and be sure they understand what is to be done.

2. There are no neutral answers, so be sure they answer all questions.

3. When they have completed, collect all questionnaires.

UNIT EXAMINATION

This unit exam was constructed to measure the students achievement of the manufacturing concepts and terminology. There are 25 multiple choice questions, each contain four possible answers. This test should take approximately thirty minutes to complete.

1. Read the directions to the students to be sure they understand what is to be done.

2. Collect all exams at the end of the designated time period.

3. When collecting the exams, be sure the students have put their names in the proper place.

APPENDIX B

UNIT EXAMINATION

Student's Name ______________________________

Unit Examination

The Enterprise System

Directions: There are 25 multiple choice questions in this test. Select the one best answer that most accurately fits the test question and circle the appropriate letter next to your selected answer. You have 30 minutes to complete this test.

1. What are the three major elements of an enterprise as presented in the slide-tape program?

   A. research, development, and design
   B. coordinating, resource, and systems
   C. management, production, and sales
   D. planning, pilot run, and production

2. Communication that takes place between individuals within the enterprise is known as:

   A. internal communication
   B. external communication
   C. direct communication
   D. indirect communication

3. Communications between the enterprise and outside elements such as billboards, magazines, television, and newspapers are examples of:

   A. internal communication
   B. external communication
   C. direct communication
   D. indirect communication

*4. Certificates which can not be spent for a given period of time then can be cashed in for more money than what they were purchased for are called:

   A. stocks
   B. loans
   C. bonds
   D. notes

   *(Refer to recommendation number eight for revised test item.)

5. People who are considered part owners of a company and receive a share of the profits are known as:

   A. trained workers
   B. bank loaners
   C. bond holders
   D. stock holders

6. A method of finance that is for fixed term and doesn't require the company to sell part ownership in the business is known as:

   A. bank certificates
   B. stock certificates
   C. bank loans
   D. savings accounts

7. Which arrangement best places the systems elements in their proper order?

   A. research and development (R and D), production, marketing, distribution
   B. planning production, R and D, distribution, marketing
   C. R and D, marketing, planning production, distribution
   D. marketing, distribution, planning production, R and D

8. The department responsible for identifying new and better products that will help keep a company ahead of its competition is named:

   A. production
   B. research and development
   C. distributing
   D. marketing

9. Which department determines the units to be produced and the kinds of products that appeal to the consumer?

   A. R and D
   B. production
   C. distribution
   D. marketing

10. The person who determines how a product is to be made as well as the order of processes is called a:

    A. research and developer
    B. production planner
    C. market surveyor
    D. distributor

11. A plan that shows how materials and parts are moved from one process to the next is called a:

    A. production plan
    B. component chart
    C. operational chart
    D. flow process chart

12. The department that tries to ensure that all components meet the engineering standards is known as:

    A. maintenance
    B. quality control
    C. production
    D. marketing

13. The elements such as forming, separating, finishing, and combining are known as:

    A. assembling
    B. components
    C. processes
    D. operations

14. The term that refers to designing and fabricating special equipment or attachments needed for production is known as:

    A. quality control
    B. assembling
    C. operations
    D. tooling-up

*15. The elements such as machining a hole, chamfering an edge, and cutting stock to length are known as:

    A. operations
    B. processes
    C. tooling-up
    D. quality control

*(Refer to recommendation number eight for revised test item.)

16. Which definition best describes the function of a jig?

    A. hold the work-piece in the proper location
    B. indicate to the worker what to do
    C. hold the work-piece and guide the tool
    D. used to check the size of workpieces

17. The moving, packing, and storing of substances in any form is known as:

    A. components
    B. assembling
    C. material handling
    D. distributing

18. The order in which the finished parts are put together to form a completed product is known as:

    A. flow chart
    B. assembling
    C. components
    D. operations

19. Which definition best describes a fixture?

    A. hold the work-piece in the proper location
    B. indicate to the worker what to do
    C. hold the work-piece and guide the tool
    D. used to check the size of workpieces

20. Single parts of a product that are processed and then later combined to form a completed product are known as:

    A. work-pieces
    B. assemblies
    C. standard stock
    D. components

21. The two basic qualifications an employer looks for in hiring a production worker are:

    A. general education and skills
    B. physical size and appearance
    C. personality and appearance
    D. education and physical size

22. What are the three main aspects of marketing?

    A. advertising, selling, and distributing
    B. managing, producing, and selling
    C. hiring, training, and promoting
    D. machining, finishing and assembling

23. Which of the following factors is <u>not</u> a major consideration in the design of a package for the product?

    A. ability to contain and hold the product
    B. display and identify the product
    C. protect the product from damage
    D. the trademark

24. Which one of the following is <u>not</u> likely to be found on a packaging label?

    A. tradename
    B. manufacturer's name
    C. product's name
    D. designer's name

25. In order for a corporation to become legally out-of-business, it must sign a legal paper known as:

    A. certificate of appreciation
    B. articles of liquidation
    C. articles of assets
    D. certificate of debts

APPENDIX C

TEACHER'S ANSWER KEY

AND

CRITERION MEASURE

TEACHER'S ANSWER KEY

The Enterprise System
Unit Examination

1. B
2. A
3. B
4. C
5. D
6. C
7. A
8. B
9. D
10. B
11. D
12. B
13. C
14. D
15. A
16. C
17. C
18. B
19. A
20. D
21. A
22. A
23. D
24. D
25. B

CRITERIA MEASURES FOR BEHAVIORAL OBJECTIVES

Behavioral Objective	Criterion Measure
1.1	1
1.2	2, 3
1.3	4, 5, 6
1.4	7, 8
2.1	9, 10
2.3	11, 12, 13, 14, 15, 16, 17, 18, 19, 20
3.1	21
6.1	22, 23
6.2	24
6.3	25

APPENDIX D

INSTRUCTIONAL ATTITUDE QUESTIONNAIRE

INSTRUCTION ATTITUDE QUESTIONNAIRE

Directions: The statements below are about the unit of instruction which you have just completed on the enterprise system. Read each statement carefully and indicate how much you agree or disagree with it according to the following scale:

SD=strongly disagree D=disagree A=agree SA=strongly agree

There are no wrong answers, simply circle the answer that best describes your honest opinion of this manufacturing unit of study.

	CIRCLE YOUR RESPONSE				
1.	I found the slide-tape presentation to be very helpful in my understanding of the enterprise system.................	SD	D	A	SA
2.	I thought the product was enjoyable and fun to make.......................	SD	D	A	SA
3.	I would recommend that the students next year mass produce the same product.....................................	SD	D	A	SA
4.	I would like to have a longer, more involved manufacturing unit next time.	SD	D	A	SA
5.	After this unit of study, I have a much better understanding of manufacturing terminology....................	SD	D	A	SA
6.	I would like to have been involved in designing and constructing the jigs and fixtures..........................	SD	D	A	SA
7.	I felt the topics discussed contribute to my learning of the enterprise system..........................	SD	D	A	SA
8.	I enjoyed the group project of mass producing the product.................	SD	D	A	SA

9. What suggestions do you have to improve the lectures and discussions? ______________________________

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10. What suggestions do you have to improve the actual mass production of the product? ____________________

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