technology - its evolution, utilization, and significance - with industry - its organization, materials, occupations, benefits resulting from the technological and industrial nature of society.

The related literature shows considerable disagreement by industrial arts educators regarding the selection of common objectives. This fact is referred to by Evans (1962, p. 30) when he stated: ". . . . industrial arts is in the unique position of having one national professional organization, which has not been able to arrive at a statement of objectives." Although this disagreement exists, the objective with respect to the development of an insight and understanding of industry and its place in our society has been included in most lists of industrial arts objectives. Thus, this objective has been an important feature of industrial arts since Richards first proposed the direction that it should take in 1904.

Despite the general acceptance of this objective by the profession, there has been much controversy in recent years concerning its achievement by the industrial arts programs in the public schools. Since no research has been done in this area, utilizing the students of the public schools of New Brunswick, it would seem that research designed to evaluate the achievement of this objective is very much in order.

## PURPOSE OF THE STUDY

The industrial arts course outline prepared by the Department of Education of the Province of New Brunswick (1968, p. 5) lists the following as an objective of the grade eight

THE UNIVERSITY OF ALBERTA

# A STUDY TO DETERMINE THE UNDERSTANDING OF INDUSTRY POSSESSED BY INDUSTRIAL ARTS STUDENTS IN NEW BRUNSWICK

by

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## ABSTRACT

The study reported here was conducted to measure the understanding of industry possessed by industrial arts students in New Brunswick. Specifically, the study was designed to compare the understanding of the functions of industry possessed by students who had taken the regular provincial industrial arts program and those who had taken an experimental program.

The study was conducted in three junior high schools in the province of New Brunswick. These schools were selected from a population of nine schools in the province which were offering both the regular and the experimental industrial arts programs.

In order to measure students' understanding of industry, a test was constructed, based upon the following eight functions of industry: Organization and Management, Research and Development, Production, Marketing, Personnel Administration, Finance, External Relations, and Secretarial and Legal Affairs.

The Understanding of Industry Test was administered to a total of sixty-nine boys who had completed a two year industrial arts program. Thirty-six students had completed the experimental program while thirty-three had completed the regular program. The students' scores on the test were used to make comparisons between the groups with respect to the understanding of industry possessed by each group.

The test data were analyzed using a two way analysis of variance method for comparing the means achieved on the test as a whole. A t-test was used to compare the means achieved on each of the eight parts of the test.

It was concluded that no significant difference existed between the means achieved, on the Understanding of Industry Test, by students who had taken the regular industrial arts program and students who had taken the experimental industrial arts program.

## ACKNOWLEDGEMENTS

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# INTRODUCTION TO THE STUDY

## INTRODUCTION

Industrial arts is regarded as an integral part of general education and as a part of the general education process it is charged with the responsibility of familiarizing the young with the world of work and its influences on our culture. Wilber (1967, p. 19) stated that:

> Of all the offerings of general education in the public schools, industrial arts is unquestionably one of the most appropriate means for developing understandings and appreciations of our industrial environment.

An understanding of the functions of industry is now commonly accepted by educators as one of the main benefits to be gained by students who take industrial arts courses. This acceptance has led industrial arts curriculum developers to attempt to close the growing gap between industrial reality and its representation in the industrial arts curriculum.

Whereas in the past these curriculum developers selected content from such sources as occupational trade analyses and project analysis, for many, industry has now become the center of attention. This view is supported by Nelson (1968, p. 5) in the seventeenth yearbook of the American Council on Industrial Arts Teacher Education:

> If there exists any one fairly universally accepted objective of industrial education, that objective would include some direct reference to modern industry as the major source from which to draw

instructional content. When questioned in depth about this, most teachers would probably state that they believe industrial arts experiences are useful in helping boys and girls become better informed about modern industry.

Although this movement has received much attention by industrial arts curriculum developers in recent years, a review of available literature reveals that industry as the source of curriculum material for industrial arts has long been promoted by some prominent educators.

Richards (1904) in an editorial, appealed to all manual training teachers to abandon what they were doing and start to build a program of instruction based upon those elements of industry which were fundamental to civilization.

Following along similar lines Bonser (1916, p. 318) provided broad parameters for the selection of these elements when he stated that the study of industry and industrial conditions should:

1. Prepare for the intelligent selection and use of industrial commodities.
2. Prepare for intelligent and appreciative citizenship as this is involved in attitudes toward industry and industrial workers . . . .
3. Help train in productive processes and methods which make the skilled and efficient workman.

More recently Hostetler (1962, p. 18) stated: "Our definitions of industrial arts portray it as a study of industry; our subject matter is derived from industry."

This statement is supported by the following definition of industrial arts by Maley (1972, p. 209):

> Industrial arts as a curriculum area is defined as those phases of general education which deal with

and nine industrial arts program: "To develop an interest and understanding of industry and its place in our society."

Spencer (1969, p. 3) states:

> The accomplishment of the stated objectives of an educational program should be the most important function of that program. When there is doubt, even controversy, concerning the extent to which objectives are being achieved, the whole program comes under fire and something must be done to amend the situation if the program is to progress.

Since changes are currently being made in the industrial arts curriculum for New Brunswick schools, the concern which Spencer describes with respect to the achievement of course objectives is typical of the situation as it exists in the industrial arts program in provincial schools at the present time.

This curriculum reorganization has resulted in essentially two programs of industrial arts, the regular program and an experimental program, both attempting to achieve the same objective. One of the major problems at this time is concerned with which program is being more successful in fulfilling this objective.

Thus, the primary purpose of this study was to ascertain the degree to which students in the two programs understand selected functions of industry. Prior to beginning work on the main purpose of the study it was necessary to conduct an examination of the following:

1. A review of pertinent studies that have developed a description of the functions of industry.
2. A review of existing tests which have been developed

for other studies of this type. This was done in order to serve as a guide for the construction of an "Understanding of Industry" test.

STATEMENT OF HYPOTHESES

Since the purpose of the study was to ascertain the degree to which a selected group of industrial arts students understood selected functions of industry, the data were analyzed and the following hypotheses tested:

1. There is no significant difference between the means achieved, on the Understanding of Industry Test, by the students in the experimental group and the students in the regular group.
2. There is no significant difference between the means achieved, on the Understanding of Industry Test, by the students in the urban schools and the students in the rural schools.
3. There is no interaction effect between the means achieved, on the Understanding of Industry Test, by the urban and rural students and the experimental and regular programs.
4. There is no significant difference between the means achieved, on the Understanding of Industry Test, by the students in the three schools with the effect of the two programs removed.
5. There is no interaction effect between the means achieved, on the Understanding of Industry Test, by the students in the three schools and the experimental and regular programs.

6. There is no significant difference between the means achieved, by the students in the experimental group and the students in the regular group, on any of the following eight test sections covered by the Understanding of Industry Test:

   a.) Test Section 1 - Organization and Management
   b.) Test Section 2 - Research and Development
   c.) Test Section 3 - Production
   d.) Test Section 4 - Marketing
   e.) Test Section 5 - Personnel Administration
   f.) Test Section 6 - Finance
   g.) Test Section 7 - External Relations
   h.) Test Section 8 - Secretarial and Legal Affairs

NEED FOR THE STUDY

The twentieth century has seen industry emerge as a dominant social institution. Drucker (1950, p. 27) states that ". . . Social scientists have described our society as one in which industry has emerged as the decisive, the representative, and the constitutive institution."

Industry and industrial technology has a direct impact on man's everyday life style. Such factors as the effect of automation on employment, life expectancy and population growth, and increased production and purchasing power require citizens who are capable of identifying and developing abilities to cope with these situations.

In discussing the aims of education for provincial public schools in The Organization of Instruction for New Brunswick

Schools (1967, p. 6) the following statement shows that an awareness of the above mentioned factors is considered to be of prime importance in the education of New Brunswick children:

> One of the features of contemporary life is the growing range and complexity of tasks on which our social organization depends. In order to further an optimum functioning of society, individuals must be prepared to perform tasks that are becoming more intricate and demanding, also constantly changing in character. Education should, therefore, strive to insure that every individual be developed to his maximum. It should provide the child with the opportunity of acquiring a wide range of knowledge and skills and also high ideals of self-improvement and service to the community.

In order to better reflect this educational philosophy the curriculum for the intermediate industrial arts program was revised and adopted for use in provincial schools in 1968. These revisions resulted in the curriculum being divided into three main instructional areas - Communications, Power and Mechanics, and Materials and Manufacturing. Curriculum materials were developed for these three areas and are currently in use in provincial schools. The committee responsible for revising the curriculum attempted to provide content designed to aid students gain a better understanding of industry and its place in society as well as the impact of industrial decisions on people in particular.

As a result of influences brought about by a number of innovative curriculum projects throughout the country, a decision was made by the provincial department of education to revise the existing industrial arts curriculum.

This decision led to extensive revisions to the materials

and manufacturing course. Beginning in February, 1972 a pilot project was initiated using the revised curriculum. The pilot project included grade eight level students in twelve provincial schools. In September, 1972 the project was expanded to include grade nine classes in the same schools.

The operation of this pilot project has resulted in two industrial arts programs, the regular and the experimental, being taught in provincial schools. In some cases both programs are being taught in the same schools.

To date no formal research has been done in New Brunswick schools with respect to evaluating the effectiveness of the industrial arts curriculum. This study was conducted to compare the two programs with regards to student achievement of the stated objective of providing the students with an understanding of the functions of industry.

A secondary objective of this study was to organize and improve a measuring instrument which would give an indication of the understanding of the functions of modern industry acquired through an industrial arts program. The test which was developed for use in this study could be used in the future to assist industrial arts teachers in determining if their students are in fact gaining an understanding of industry.

## DEFINITION OF TERMS

Understanding of Industry is a shortened form of the industrial arts objective which is stated "To develop in each student an appreciation and understanding of industry and

its place in our society."

Understanding Industry Test is a multiple-choice test designed to test student knowledge of the following functions of industry: organization and management, research and development, production, marketing, finance and control, personnel, external relations, and secretarial and legal affairs.

Regular Industrial Arts Program is the program prescribed by the province of New Brunswick for all grade eight and nine boys. It involves a study of the following three main areas: Communication, Power and Mechanics, and Materials and Manufacturing.

Experimental Industrial Arts Program is a revised program for grade eight and nine boys which is being piloted in twenty-two junior high schools in the province of New Brunswick. The revisions were made primarily in the materials and manufacturing area by adapting materials from the Ohio State University's Industrial Arts Curriculum Project, World of Manufacturing Course (1971).

## METHOD

The study was approached in three phases. The first phase involved a review of related literature in order to provide a detailed description of the characteristics of industry so as to provide the information necessary for the construction of an understanding industry test. The second phase involved the construction and validation of the test instrument. The third phase involved the selection and testing

of the students in the sample and the analysis of the test results.

A. PHASE ONE

A review of available literature showed that the term industry has many meanings and as a result there are many ways of describing industry. Based on an examination of the literature it was found that the categories as identified by the Association of Consulting Management Engineers (1970) were representative of a common body of knowledge for industry. The categories are: Management and Organization, Research and Development, Production, Marketing, Finance and Control, Personnel, External Relations, and Secretarial and Legal Affairs.

B. PHASE TWO

The eight categories and their functional elements which were subdivided by the Institute of Industrial and Career Development at Georgia Southern College (1969), and used in developing an industrial arts manufacturing curriculum, were used as a guide in developing a series of multiple-choice questions.

The test questions were validated in two ways. First by a panel of jurors composed of graduate students from the Department of Industrial and Vocational Education at the University of Alberta. Second, a pilot test was administered to grade nine students from two schools in the Edmonton area.

The results of this test were subjected to an item analysis in order to further improve the quality of the instrument. This procedure resulted in eighty questions

being selected for the Understanding of Industry Test.

C. PHASE THREE

Six classes of industrial arts students were selected for testing from among the English speaking junior high schools of the province of New Brunswick. Three of the classes tested were taking the experimental industrial arts course, while the remaining three classes were taking the regular industrial arts course.

The sample was further broken down so that four of the classes tested were from urban schools while the remaining two classes were from rural schools.

Item analysis tests were performed in order to determine the reliability of the test, while a two-way analysis of variance test was performed to test the null hypotheses.

## SCOPE AND LIMITATIONS OF THE STUDY

The study was carried out in three New Brunswick junior high schools and involved grade nine English speaking boys. The generalizability of the results is limited to the extent that these schools and students are representative of similar schools and students throughout the province.

Since the conclusions drawn in this study were based on scores obtained on the Understanding of Industry Test, the accuracy of the test is a limiting factor even though an effort was made to validate the test before it was used.

This study is limited further in that the teachers whose classes were included in the sample, had participated in a workshop directed toward teaching the experimental

program. Since these teachers taught both the regular and experimental classes, the instruction of the regular classes may have been more like that of the experimental classes than would have been the case if other teachers' classes had participated in the study.

# CHAPTER 2

## REVIEW OF THE LITERATURE

The related literature for this study was surveyed firstly, to trace the historical development and source of content for industrial arts in order to identify its purpose or objectives. Secondly, to review other studies that have been done in evaluating the achievement of industrial arts objectives.

### DEVELOPMENT OF INDUSTRIAL ARTS CONTENT

Industrial arts as a subject area has had a relatively short history. However, the roots of the content of the subject can be traced back many years.

Bennett (1926, p. 31) quotes Martin Luther (1483-1546) as saying:

> My opinion is that we must send boys and girls to school one or two hours a day, and then have them learn a trade at home for the rest of the time. It is desirable that these two occupations march side by side.

Comenius (1592-1670) is credited with being the father of modern pedagogy, since the methods and principles he advocated were in harmony with those advocated for handwork when it was introduced. His "method of the arts" provided for tryout courses, self-discovery, and educational guidance. It was his belief that children would discover their special aptitudes if they were given instruction in the mechanical arts along with academic subjects.

One hundred years after Comenius had laid the foundation

of his "learning through activity" program, Pestalozzi (1746-1827) established a system that was built around such crafts as spinning and weaving. His ideas provided for extensive use of natural objects or models and drawing became one of the fundamental studies in his schools.

Froebel (1783-1852), who worked under Pestalozzi and became imbued with the importance of hand work in education, developed an educational theory in which the core was self activity.

Phillips (1957, p. 423) states that:

> A concrete example of the Froebelian influence was the establishment of manual training and domestic science classes at the beginning of the century. Manual activity and the education of the child for the whole life were part of the Froebelian scheme. Early manual training was Pestalozzian, since it aimed at developing successive skills, like the ability to handle the saw, the plane, and the chisel. It became Froebelian as it discarded this approach in favor of allowing the boy to make some article as soon as possible.

Although the work of these early educators had considerable influence on the development of industrial education, Smith (1973, p. 20) points out: ". . . .the ideas of industrial education were expressed and some experimental programs developed, widespread acceptance of this type of education did not materialize until the industrial revolution." It was not until the late nineteenth and early twentieth century that programs were developed as forerunners to the present industrial education programs. Gallagher (1963, p. 31) points out that: "The literature generally agreed that four types of programs had influenced industrial arts theory and practice." These programs are the Russian technical training

system, the Sloyd system, manual training, and manual arts. Some of the characteristics of these programs as they influenced the development of industrial arts theory and practice are outlined in the following descriptions of the programs.[1]

## THE RUSSIAN SYSTEM OF TECHNICAL TRAINING

The Russian system had its origin about 1868 in the work of Victor Della Vos. It was designed to train engineers and builders to construct railroad cars and locomotives in groups rather than by individual persons. This system was a formalized system based on the principle of a logical method of procedure in which exercises were assigned in order of increasing difficulty and were completed by students in that order. Each course of instruction consisted of a series of graded exercises without reference to the construction of a useful article. The teaching of the course was done in three stages: first, a study of tools and materials; second, a development of skills in the use of the materials under study; third, the construction stage in which whole or parts of projects were made. Emphasis was also placed on freehand and mechanical drawing throughout the course.

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[1]The information in this section is summarized mainly from the following sources. Barlow,M.A. History of industrial education in the United States. Peoria, Illinois: Chas. A. Bennett Co.,Inc., 1967. and Olson,D.W. Industrial arts and technology. Englewood-Cliffs,N.J., Prentice-Hall Inc., 1963.

## THE SWEDISH SLOYD SYSTEM

The Sloyd method, which was developed in the Scandinavian countries, had its origin in the home industries, which involved the making of such articles as kitchen utensils, tools, handles and other useful articles. As interest in the movement spread, courses were established in schools in these countries during the latter part of the nineteenth century. The movement spread and was used in a number of Boston schools about 1890.

The outstanding characteristics of the sloyd system were: the individual method of instruction, the use of a useful model, and the encouragement of student initative and self direction. Special importance was attached to neatness, accuracy, finish and the desire to do good work.

Credit for the development of educational sloyd is given to Otto Salomon who refined the method by focusing attention on making useful objects, analysis of operations and educational methods.

The development of manual training, the American version of educational shopwork, was based on ideas developed in the Russian technical system and educational sloyd.

## MANUAL TRAINING

Calvin M. Woodward (1831-1914) is commonly known as the father of manual training. He founded a manual training school in St. Louis in 1880 and his teaching was heavily influenced by the Russian technical system of training. Woodward, in his writing became the first to spell out in educational terms, the objectives, content, and methods of

teaching manual training. Manual training was considered to be an important part of general education, and stressed the development of the mind through the hands based on handwork instruction in the elementary industrial processes.

MANUAL ARTS

Manual arts followed in the path of manual training and was promoted because manual training was criticized as being too narrow, too rigid and formal, and lacking in an aesthetic approach.

The manual arts movement advocated broadening the activities of manual training and placing emphasis on the aesthetic approach to handwork. Charles A. Bennett, who is referred to by Olson (1963, p. 5) as being the father of the manual arts movement, promoted the idea of giving instruction in various industries. His classification of subject matter was derived from the graphic arts, the mechanic arts, the plastic arts, the textile arts, and the bookmaking arts.

INDUSTRIAL ARTS EDUCATION

During the early part of the twentieth century many manual training educators objected to the emphasis on skill development and formalized instruction in the previously described movements. They suggested that manual training should center more attention on a study of industrial processes that result in changing new materials into usable products. It was in this atmosphere that industrial arts had its birth.

In 1904 Charles R. Richards suggested that a change

in philosophy, as well as a new name, was needed. In a well known editorial he suggested the name "Industrial Arts" as being representative of this thinking. Olson (1963, p. 5) quotes Richards as saying:

> It is no longer merely a question of improving an indefinite title, but of replacing one that is inappropriate and incorrect in its implication. The old term is not only vague, it has become misleading as an indication of the aim and character of work. Now that we are beginning to see that the scope of the work is nothing short of the elements of the industries fundamental to modern civilization, such a term becomes at once a stumbling block and a source of weakness. The whole matter would not be of such importance were it not for its bearing upon the nature and spirit of the work projected in the schools and its future trend.

Bonser and Mossman (1924, p. 15) established the purpose and indicated the content for industrial arts when they provided their much quoted definition of industrial arts.

> The industrial arts are those occupations by which changes are made in the forms of materials to increase their values for human usage. As a subject for educative purposes, industrial arts is a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes.

The review of literature to this point has shown that industrial arts can trace its beginning to the Russian technical system, educational sloyd, manual training and manual arts. Its name was derived from Richard's proposal for a "new name" and the purposes and content from the definition by Bonser and Mossman.

During the past two decades much work has been done in developing industrial arts content. Recent literature contains statements which indicate the definite body of subject

matter from which contemporary industrial arts programs should draw their content. The following selections from the literature clearly points this out.

Hornbake (1957, p. 14-15) comments:

> ... The acceptance of industrial arts into the family of school disciplines assumes that the world of work, particularily the phenomena of industry, constitutes a legitimate area of study. Can a person who lives in an industrial democracy lay claim to being an educated person if he has not become aware of the basic processes by which society maintains itself?
>
> .... It is only as we are able to relate the world of work to education that industrial arts becomes a curriculum area worthy of consideration.

Speaking a year later to members of the Ontario Industrial Arts Association, Hornbake (1958,) stated:

> Responsible behavior in an industrial society requires every person, regardless of his occupation, to know something specific about the operation of industry.
>
> ... In substance, our first social responsibility is to help our children and youth understand the world in which they live. Industry is a very dominant element in this society.

The following comment by Luetkemeyer (1968, p. 17) appears in the seventeenth yearbook of the American Council on Industrial Arts Teacher Education:

> A review of the literature in industrial arts indicates that its curriculum has, as its unique function in the formal school, the transmission of a knowledge of industry to the young. By its very definition, as developed by such recognized leaders in the field as Bonser, Fales, Wilber, Hostetler, and Schmidt, industrial arts embodies two important principles: "that industrial arts is part of general education" and that industry is "the source of its content."

Stadt (1969, p. 23) also refers to industry and the world of work when writing in the Journal of Industrial Teacher

Education:

> The content of industrial arts should be representative of, and interpretative of, the world of work. Awareness and understanding of many kinds of industries, kinds of production units, occupations, technological principles and processes, and the social psychological forces at work should be created. Stripped of detail the objective of industrial arts, is to create awareness of the hidden, subtle forces which are generated by industry, trade, and commerce and impinge upon individuals and groups engaged directly or indirectly in the production of goods and services, and to lend intelligibility to those forces.

## DEVELOPMENT OF INDUSTRIAL ARTS OBJECTIVES

A review of the literature concerning the objectives of industrial arts, through the years of its evolution shows that numerous statements of purposes have been prepared by various individuals and organizations. This review showed that while some of the emphasis and claims made for industrial arts have changed others have remained unchanged. The understanding of industry objective is one which has retained a place of importance in the development of objectives for industrial arts.

A statement of objectives prepared by a committee of the American Vocational Association (1934, p. 12) included the following objective "... To develop in each pupil an active interest in industrial life and in the methods of production and distribution."

The American Vocational Association publication, A Guide to Improving Instruction in Industrial Arts (1953, p. 18) provides a list of nine objectives which includes the understanding of industry objective.

Wilber (1948, pp. 42-43) formulated nine objectives

of industrial arts. The first of these objectives is, "... To explore industry and industrial civilization in terms of its organization, raw materials, processes and operations, products and occupations."

In its latest statement of objectives the American Vocational Association (1968, pp. 9-11) lists as the first objective for industrial arts "... To develop an insight and understanding of industry and its place in our culture.

This literature review shows that as industrial arts has developed over the years the pattern for the selection of content has moved from a skill oriented type of program to one in which a study of industry is of prime importance. This fact leaves little doubt that a study of the functions of industry should be a primary objective of all industrial arts programs.

REVIEW OF RELATED STUDIES

A review of the studies which have been made to determine the effectiveness of industrial arts programs and objectives has indicated that few studies have been done in this vital area. The Fifteenth Yearbook of the American Council on Industrial Arts Teacher Education (1966), dealing with the status of research in industrial arts, devotes one chapter to the achievement of industrial arts objectives. The chapter provides a brief review of six doctoral dissertations and two masters' theses which were concerned with the achievement of industrial arts objectives.

As indicated by the authors, the above studies do not necessarily include all of the research that has been done

in this area, however, it gives an indication of the lack of research which is related to objectives in general. As a result research related to the understanding of industry objective is even more limited.

A review of the available studies has indicated two schools of thought with respect to the meaning of the objective understanding of industry. One approach looks at a study of industry as being limited to such aspects of industry as, tools, materials, processes, and products. The second approach views industry in a broader light and includes more of the total picture of industry such as organization, research and development, and production.

The latter interpretation of the understanding of industry is the one utilized in this study.

LINDBECK'S STUDY

A study by Lindbeck (1958) followed the first interpretation of the understanding of industry objective. This study was an investigation into the derivation of the generalizations or claims for industrial arts.

The first part of Lindbeck's study involved the drafting of a system of hypotheses and sub-hypotheses to serve as a framework for further research in industrial arts. The second part of his study, which is of concern here, involved the construction of a test designed to evaluate the objective, "industrial arts promotes an understanding of industry and the value of the worker". (p. 52)

Lindbeck formulated the hypothesis which in effect stated that individuals who have been exposed to experiences

in industrial arts classes acquire an understanding of industry and the value of the worker as a result of these experiences. From this hypothesis a series of sub-hypotheses were developed and the following sub-hypothesis, "Industrial arts students score higher on the industrial knowledge test than non-industrial arts students", was selected for testing.

A test was constructed, validated and after revisions it was administered to two groups of high school seniors. One group had taken industrial arts metals courses beyond the junior high school, the other group had no such courses beyond the junior high school.

Using an analysis of co-variance technique with the variable of intelligence controlled, Lindbeck found no significant difference between the industrial knowledge test means of the two groups. Lindbeck concluded: "It can only be said that in the manner in which the sample survey proceeded, there appears to be no significant difference between the two types of students with respect to an industrial knowledge test." (p. 126)

The test used by Lindbeck was not designed to test industry wide principles, but was concerned with one industry, metals, and with rather specific recall of detailed items which asked for the recall of names of tools, materials, and processes directly related to metalworking. The more general approach to the understanding of industry was not covered by the test.

## BLOMGREN'S STUDY

A study by Blomgren (1962) attempted to ascertain the growth of a selected group of industrial arts education majors at Illinois State Normal University toward gaining an understanding of American industry. For purposes of developing an understanding of industry test he limited the study to the following areas of industry: history of industry, labor and management organizations, management in industry, and technology of production. In developing the rationale for the content of the test Blomgren states:

> It seemed that a general approach was necessary and that it should not be a description of a single industry, such as the printing industry, but rather it should be an attempt to describe modern industrial America. The description should not be too involved with the details of materials, tools, and processes. (p. 21)

The procedure used by Blomgren for the construction of the test was to review a series of books from areas such as industrial economics, industrial engineering, industrial history, industrial management, industrial psychology, and industrial sociology. From this review an outline of industry was developed and the test questions were constructed following this outline.

In order to ascertain the growth of students who majored in industrial arts towards gaining an understanding of industry, Blomgren tested a group of freshmen and a group of senior industrial arts majors as well as similar groups of freshmen and senior social science majors. The gain in understanding of industry was determined by comparing the scores achieved on the test by the four groups.

Based on these scores, Blomgren found that industrial arts majors do in fact gain understanding of industry during their four years of college. Freshmen industrial arts students were found to enter college with less understanding of industry than do social science freshmen. Although it was found that industrial arts majors gained understanding of industry during the four years of college they still did not possess a greater understanding than social science majors, and in the area of labor and labor organizations the social science majors scored significantly higher.

SPENCER'S STUDY

A study by Spencer (1969) was conducted in order to determine the extent to which the objective, understanding of industry was being achieved in public secondary schools.

More specifically the study attempted to ascertain relationships between the following:

a. The understanding of industry possessed by students with industrial arts experience and that of students without industrial arts experience.
b. The number of semesters of industrial arts completed and students' understanding of industry.
c. The technical area in which industrial arts courses were taken and students' understanding of industry.
d. The grade level at which industrial arts courses were taken and students' understanding of industry.
e. The importance attached to the objective under-

standing of industry by their industrial arts teachers and students' understanding of industry.

In identifying the body of knowledge to be used in constructing the understanding of industry test he identified two areas; analysis of industry, which included a list of various industries and components of industry. The opinions of industrial arts educators were solicited in order to determine what should be included in these two areas in order to promote an understanding of industry.

In developing the rationale for this selection of content Spencer states: (p. 25)

> In view of the controversy over the meaning of the understanding of industry objective, it was decided that an attempt should be made to ascertain the most common interpretation of the objective among industrial arts educators. This would in effect define the body of knowledge which the test would have to cover.

From these opinions Spencer selected twelve industries and five components to be used in developing the test. The content used for the construction of test items in these areas was identified from textbooks published for the industrial arts field. The textbooks used provided a description of the selected industries and components.

A pilot test was constructed and submitted to graduate students, who had experience in teaching industrial arts and were enrolled in the Industrial Education Department at the University of Missouri, for criticism. The test was revised and administered, and the results were analyzed to determine the reliability of the test. The final test of

eighty multiple choice test items was then constructed.

In order to measure the contribution of industrial arts to understanding of industry, Spencer tested two groups of grade eleven high school students, randomly selected from the high schools of Kentucky. One of the groups had industrial arts experience while the other group had no industrial arts experience.

Based on a comparison of the scores obtained by testing the two groups Spencer found that students with industrial arts experience possess a greater understanding of industry than students with no industrial arts experience. He also found that five or more semesters of industrial arts was required to enable students to gain a greater degree of understanding of industry than students with no experience in industrial arts. No difference was found between students with experience in general shop courses which provide a variety of activities, and students with experience in unit courses, which provide specialized activities. It was also found that students whose teachers ranked the understanding of industry objective high in importance, scored higher than those students whose teachers placed less importance on this objective.

SUMMARY

From the results of the studies that were reviewed, it cannot generally be concluded that industrial arts programs have been successful in achieving the understanding of industry objective. This fact would lead one to realize that further research into this area is still necessary.

# CHAPTER 3

# METHODOLOGY

The primary purpose of this study was to ascertain the degree to which students, enrolled in the experimental and the regular industrial arts programs in New Brunswick schools, understand selected functions of industry.

This chapter outlines the experimental design that was used in this study. It contains a description of the population used in the study, the sample of students used for testing, the test instrument used and the design of the experiment.

## SAMPLE

The groups included in the study consisted of students enrolled in grade nine industrial arts classes in the English speaking junior high schools of New Brunswick. Schools were selected from those which offered both the experimental and the regular industrial arts courses. Since industrial arts is offered only at the grade eight and nine level in New Brunswick schools, ninth grade students were selected for testing because they had completed all of their industrial arts program at the time the data were collected.

The sample, which consisted of a total of sixty-nine boys, was selected in the following manner. The nine junior high schools which made up the population for this study

were divided into two groups, urban and rural[1]. Five of the schools were found to be from urban districts while the remaining four were from rural areas.

Three schools were selected from this population, two from the urban school group and one from the rural school group. Six classes were selected for testing, from a total of twenty-seven grade nine classes, in the three schools. Three of the classes selected had taken the regular industrial arts program and three had been involved in the experimental industrial arts program.

The experimental industrial arts group consisted of thirty-six students who had completed both the grade eight and nine courses of the revised industrial arts program. These students were from New Albert School and Bayside Junior High School in urban School District 20 and Nackawic Junior High School in rural School District 28.

The regular industrial arts group consisted of thirty-three students who had completed both years of the regular industrial arts program as prescribed by the Industrial Arts Course Outline of the New Brunswick Department of Education (1969). These students were also selected from the above named schools.

The experimental procedure followed in conducting the research in this study was restricted by the limitations

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[1]For purposes of this study: Urban and rural are defined by Webster's Seventh New Collegiate Dictionary (1969) as follows. Urban is defined as relating to, characteristic of, or constituting a city. Rural is defined as relating to the open country or farming area.

placed on it by the schools in the population. This resulted in a limited number of classes and a limited amount of time being made available to the researcher for the testing of the students. These factors necessitated making use of the four urban and two rural classes used in the study.

RESEARCH DESIGN

The nature of the research design used for this project was the posttest-only control group design. Since the study intended to evaluate and compare the results of selected aspects of two instructional programs that were already completed the researcher had no opportunity to perform any pretesting of the students in the sample or to exercise any controls over the instructional process.

The research design format used was:

S $X_1$ $O_1$

S $X_2$ $O_1$

Where S was the selection of students

$X_1$ was the experimental course

$X_2$ was the regular course

$O_1$ was the understanding of industry test

The contribution of the two programs to the understanding of industry objective was ascertained by comparing the scores, on the Understanding of Industry Test, of students who had taken the experimental course against the scores of a similar group of students who had taken the regular course. For purposes of this study any difference in the results on

the test was attributed to the type of program followed.

THE UNDERSTANDING OF INDUSTRY TEST

In order to determine the students' understanding of industry, which was the main purpose of this study, it was necessary to construct an instrument which would measure this knowledge.

Prior to constructing this instrument, the literature was searched to determine what other attempts had been made to develop an instrument that would be suitable for this purpose. It was discovered that four such instruments were available.

Lindbeck (1958) developed an Industrial Knowledge Test as part of a research project. However, an examination of this test revealed that it delt primarily with the area of metalworking at the high school level and was considered unsuitable for purposes of this study.

Blomgren (1962) developed an Understanding of American Industry Test, also as part of a research project. However, as indicated in the review of the literature in chapter two, this test was developed for university students and was found to be unsuitable for use at the junior high school level. Since the areas covered by Blomgren in developing his test were similar to those selected for use in this study a number of the questions were found to be usable.

Spencer (1969) also developed an Understanding of Industry Test to be used in a research project. Many of the questions used by Spencer were in specific subject areas such as welding, auto mechanics, and construction electricity

and as a result were considered unsuitable for the junior high school level.

The Co-operative General Industrial Arts Tests which were developed and supplied by the Educational Testing Service (1970) were found to be unsuitable for evaluating the understanding of industry objective since they are designed to measure student achievement in specific areas such as woods, metals, drawing, and electricity.

However, although dealing with selected aspects of industry they were not concerned with the functions of industry, therefore, an instrument had to be developed for this study.

## DEFINING THE BODY OF KNOWLEDGE

Luetkemeyer (1968, p. 18) gives an indication that an internal conflict exists, among industrial arts educators, with regards to the understanding of industry objective when he writes that:

> A problem arises, however, in discerning the specific content for industrial arts. For while industrial arts educators generally agree that industry is the source of their fields content, their opinions concerning the actual nature of industry are in conflict. Thus, while each of these different schools of thought has evolved its own concept of industry, with corresponding methodoligical principles, the dilemma of discerning a specific content for industrial arts has become more apparent.

Nelson (1972, p. 144) attempts to clear up the problem when he states:

> A common body of knowledge for industry has been identified and accepted by professional consultants in industry. The Association of Consulting Management Engineers (1957) divides this knowledge into: Management and organization; Research and Development;

> Production; Marketing; Finance and Control; Personnel Administration; External Relations; and Secretarial and Legal Affairs.
>
> .....
>
> These activity areas and their functions, subfunctions and major functional elements comprise what professionals in industry term the Common Body of Knowledge for Management Consultants and consequently should be acceptable to the educational area which purports to study industry.

For the purposes of this study it was decided to accept these main areas to serve as a basis for the construction of the Understanding of Industry Test.

A further search of the literature revealed that these eight functions had been sub-divided into functional units for the purpose of developing an industrial arts curriculum that was representative of industry. This work was done by the Institute of Industrial and Career Development at Georgia Southern College (1969). This analysis was presented in an outline form and was used by this researcher as a guide for the construction of the test items. The outline is shown in appendix B.

It was decided that the reverse-multiple choice type of question would be the most satisfactory to use for this test. Blomgren (1963, p. 57) supports this decision by pointing out:

> . . . there are apparently two features of this type of question, the reverse-multiple choice, that make it particularily useful in developing questions of a general nature. It is easier to construct three or four responses that are true, than to make several plausible but wrong answers. Also, a person taking the test seems to consider more choices with this type of question and it could be said that more interpretation and discrimination are demanded.

In construction of the test items care was exercised to construct questions that would test a students understanding of the basic elements or functions of industry and to avoid questions that called for specific recall of facts.

The material for the test questions was obtained from industrial arts textbooks, textbooks on industrial organization and management, and the previously mentioned tests that had been developed for other related studies.

Test items were developed to cover each of the major points in the outline. This resulted in a total of one hundred and twenty-five questions in the first draft of the test.

These questions were reviewed by a panel of graduate students from the department of Industrial and Vocational Education at the University of Alberta. As a result of this review a number of questions were rewritten and a number were discarded. This procedure resulted in a total of one hundred and one questions which were organized in test format to be used in a pilot test.

PILOT TEST

The pilot test was administered to three classes of grade nine students in the Edmonton school systems. Two of the classes were from D. S. MacKenzie Junior High School and one from St. Brendan's School. A total of thirty-nine students took the test.

The answer sheets were scored by the University of Alberta Optical Scorer Service and the results were analyzed

using the DERS:TEST04 computer program. This program provided an overall reliability measure for the test as well as reliability, difficulty, and discrimination values for each item.

The reliability coefficient for the test as a whole, computed using the Kuder-Richardson 20 formula, was 0.8122.

The difficulty and discrimination values for each item were examined and used in the selection of the items for the final test. Items with a low reliability index were either dropped or revised using the other information given by the item analysis.

FINAL TEST

The final test consisted of eighty reverse-multiple choice questions. The final form of the test was determined by an item analysis, student reaction to questions, and to some degree by the time restrictions placed on the researcher by the schools involved in the study. It was considered desirable to have the students complete the test in one fifty minute period. Therefore, eighty questions were selected as being a reasonable number to be completed in this time period.

SUMMARY

The plan of this study was to determine the degree to which the students in the two industrial arts programs offered in New Brunswick schools, understood the functions of industry as selected for use in the study.

The population for the study was the nine junior high

schools in New Brunswick that were offering both the experimental and the regular industrial arts programs. The sample used for testing was sixty-nine students, selected from the population.

The students' understanding of industry was ascertained by using a test constructed for this study.

The test was constructed using the following procedure:

First, an outline of the functions to be tested was determined. These elements had previously been identified by industrial consultants and accepted by industrial arts educators as being representative of the functions of industry.

Second, test questions were developed using an outline that had been determined by members of the industrial arts profession and from these questions a pilot test was developed and administered to a group of students.

Third, the results of this pilot test were analyzed and from this information the final test of eighty reverse-multiple choice questions was constructed.

# CHAPTER 4

## STATISTICAL ANALYSIS

The purpose of this chapter was to present the analyses of the data which were obtained by administering the Understanding of Industry Test to a group of grade nine industrial arts students from New Brunswick schools. The chapter provides a report of the overall test results, the test reliability, and the testing of the hypotheses stated in Chapter 1.

Computations for the statistical tests were done by the University of Alberta's 360/67 computer system.

### OVERALL TEST RESULTS

The test groups were composed of 36 students who had taken the experimental industrial arts program and 33 students who had taken the regular industrial arts program in three schools in New Brunswick. The total number of students tested was 69. The mean score of all students who took the test was 42.38, with a variance of 105.68. The mean and the variance of each of the classes tested is shown in TABLE 1.

The mean score of the combined experimental groups was 43.41 with a variance of 89.16. The mean score of the combined regular groups was 41.24 with a variance of 124.50. These figures are shown in TABLE 2.

TABLE 1

MEAN AND VARIANCE OF THE SIX CLASSES TESTED WITH THE UNDERSTANDING OF INDUSTRY TEST

| | New Albert | | Bayside | | | | |
|---|---|---|---|---|---|---|---|
| | Experimental Class | Regular Class | Experimental Class | Regular Class | Experimental Class | Regular Class | Total |
| Number | 12 | 11 | 14 | 10 | 10 | 12 | 69 |
| Mean | 43.83 | 36.0 | 41.93 | 42.09 | 45.0 | 45.33 | 42.38 |
| Variance | 107.79 | 115.80 | 77.15 | 129.43 | 97.11 | 104.61 | 105.68 |

TABLE 2

MEAN AND VARIANCE OF THE COMBINED EXPERIMENTAL AND REGULAR CLASSES ON THE UNDERSTANDING OF INDUSTRY TEST

| | Experimental Classes | Regular Classes | Total |
|---|---|---|---|
| Number | 36 | 33 | 69 |
| Mean | 43.41 | 41.24 | 42.37 |
| Variance | 89.16 | 124.50 | 105.68 |

Since the understanding of industry test was made up of questions on eight selected functions of industry, the students test scores were broken into eight parts in order to give an indication of how well each group did on the questions dealing with each of these functions. TABLE 3 shows the mean scores of the experimental and regular groups on each of the eight parts of the test.

TABLE 3

MEAN SCORES FOR THE EXPERIMENTAL AND REGULAR GROUPS ON THE EIGHT FUNCTIONS OF THE UNDERSTANDING OF INDUSTRY TEST

| | Experimental Group | Regular Group | Combined Groups | Total Questions |
|---|---|---|---|---|
| 1. Organization and Management | 4.97 | 4.42 | 4.71 | 10 |
| 2. Research and Development | 6.00 | 6.00 | 6.00 | 12 |
| 3. Production | 7.86 | 7.30 | 7.59 | 14 |
| 4. Marketing | 7.17 | 7.03 | 7.10 | 12 |
| 5. Personnel Administration | 6.14 | 6.03 | 6.08 | 10 |
| 6. Finance | 4.64 | 4.55 | 4.59 | 8 |
| 7. External Relations | 2.86 | 2.24 | 2.56 | 7 |
| 8. Secretarial and Legal Affairs | 3.78 | 3.67 | 3.72 | 7 |

TEST ITEM ANALYSIS

The DERS:TEST04 program for item analysis was used to provide an item analysis for the understanding of industry test results.

The test reliability which is computed using the Kuder-Richardson 20 formula was found to be 0.849. This measure can range from 0.00 to 1.00 with a higher reading indicating a greater reliability.

The test item difficulty which gives an indication of the percentage of students who correctly answered each test item ranged from 0.09 to 0.91. TABLE 4 gives a graphic representation of the difficulty indices for all items in the test.

The biserial correlation which measures the relationship between student performance on a specific test item and performance on the test as a whole gave readings from -0.18 to 0.77. Five questions on the test had a negative correlation.

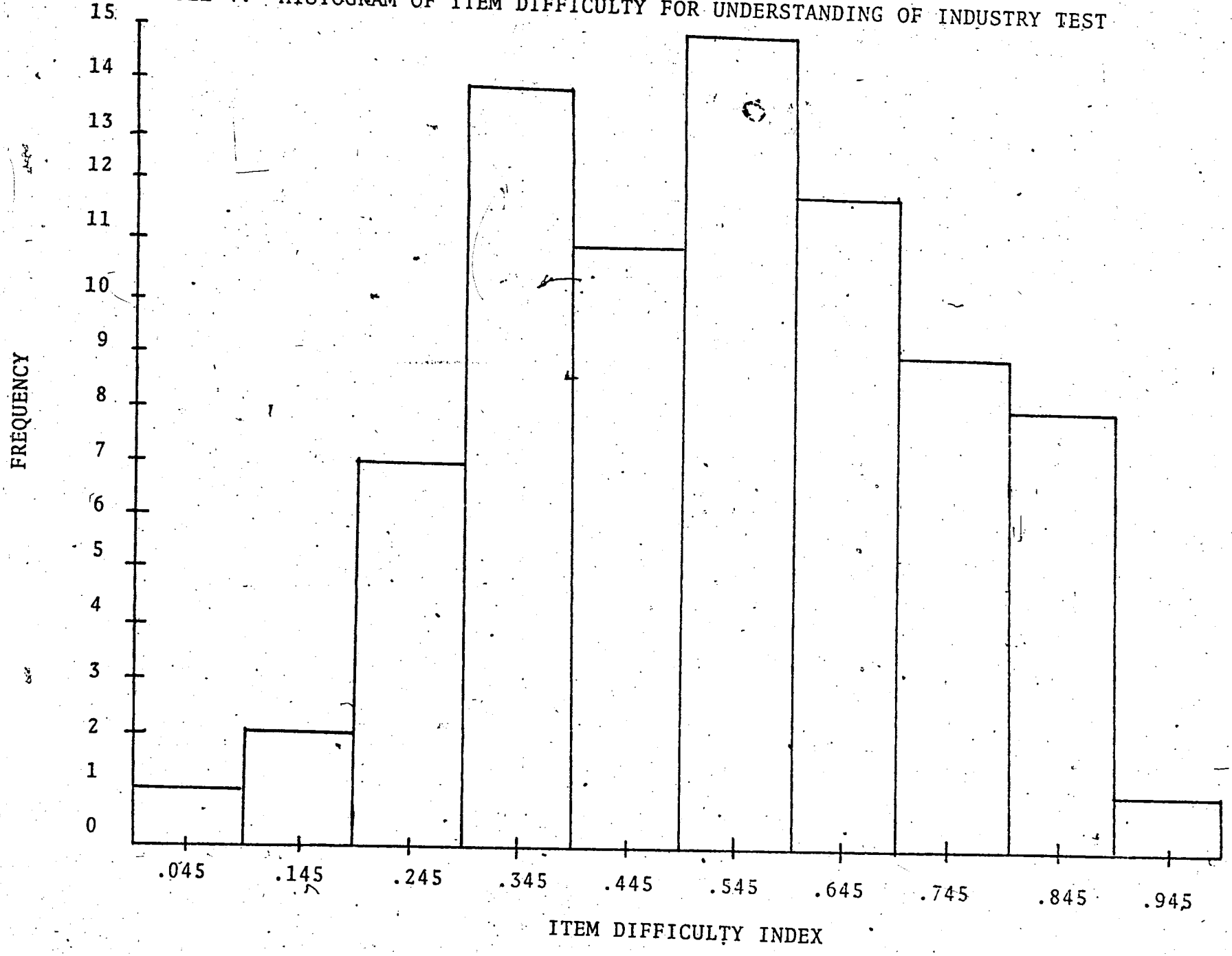
The item reliability index, which is used to determine the effectiveness of the test item when simultaneously considering the item difficulty index and the item biserial correlation, ranged from -0.01 to 0.32.

The item analysis data for each of the test items can be found in APPENDIX D.

TESTS OF THE HYPOTHESES

Two types of comparisons were made in the analysis of the test data. Hypotheses one to five were tested using a

TABLE 4: HISTOGRAM OF ITEM DIFFICULTY FOR UNDERSTANDING OF INDUSTRY TEST



of the students in the two programs was 1.005 with a probability level of 0.32. With degrees of freedom of 1 and 63, obtained from TABLE 5, the value of F required for significance at the 0.05 level is 3.99. These results indicated that there was not a significant difference between the two groups when considering the effect of the experimental and the regular programs. As a result of these observations the null hypothesis was not rejected.

Hypothesis 2 Test

Hypothesis 2 stated that there was no significant difference between the means achieved, on the understanding of industry test, by the students in the urban schools and the students in the rural schools.

This hypothesis was also tested using a two-way analysis of variance technique. In this the criterion variable was the urban and rural schools and the dependent variable was all of the students in the two programs.

The results of the analysis of variance done for this hypothesis is shown in TABLE 6.

TABLE 6

2 BY 2 TWO-WAY ANALYSIS OF VARIANCE FOR URBAN AND RURAL GROUPS

| Source | D.F. | Mean Square | F Ratio | Probability |
|---|---|---|---|---|
| Urban-Rural Effect | 1 | 283.64 | 2.73 | 0.10 |
| Program Effect | 1 | 110.95 | 1.07 | 0.30 |
| Interaction | 1 | 666.11 | 0.64 | 0.43 |
| Within | 65 | 103.92 | | |

The F-ratio obtained when comparing the means of the urban and rural students was 2.73 with a probability level of 0.10. With degrees of freedom 1 and 65, obtained from TABLE 6, the value of F required for significance at the 0.05 level is 3.99. These results led to the conclusion that no significant difference existed between the means of urban and rural students, and as a result the null hypothesis was not rejected.

Hypothesis 3 Test

Hypothesis 3 stated that there was no interaction effect between the means of the urban and rural students, on the understanding of industry test, and the experimental and regular programs.

This hypothesis was tested in the same way as hypothesis 2 and the results are shown as interaction in TABLE 6.

The F-ratio obtained in this test was 0.64 with a level of probability of 0.43. Since the expectation on the basis of the null hypothesis is unity, the results obtained led to the conclusion that there was no significant interaction between the two variables. The null hypothesis was not rejected.

Hypothesis 4 Test

Hypothesis 4 stated that there was no significant difference between the means achieved by the students in the three schools irrespective of the programs they were taking.

This hypothesis was tested in the same way as hypothesis 1 and the results are shown as school effect in TABLE 5.

The F-ratio obtained in this test was 1.54 with a probability level of 0.22. With degrees of freedom 2 and 63, obtained from TABLE 5, the value of F required for significance at the 0.05 level is 3.14. The results indicated that there was not a significant difference between the means of the students in the three schools. The null hypothesis was not rejected.

Hypothesis 5 Test

Hypothesis 5 stated that there was no interaction effect between the means of the students in the three schools and the experimental and regular programs.

The test used for this hypothesis was the same as the one used for testing hypothesis 1 and the results are shown as interaction in TABLE 5.

The F-ratio obtained in this test was 1.20 with a level of probability of 0.31. As in the test for hypothesis 3 the expectation for this test was unity. The results obtained led to the conclusion that there was no significant interaction between the two variables. Therefore, the null hypothesis was not rejected.

Hypothesis 6 Test

Hypothesis 6 stated that there is no significant difference between the means achieved by the students in the experimental group and the students in the regular group in any of the following eight test sections of the understanding of industry test.

a.) Test Section 1 - Organization and Management

b.) Test Section 2 - Research and Development

c.) Test Section 3 - Production

d.) Test Section 4 - Marketing

e.) Test Section 5 - Personnel Administration

f.) Test Section 6 - Finance

g.) Test Section 7 - External Relations

h.) Test Section 8 - Secretarial and Legal Affairs

A t-test was used to determine if there was a difference in means for the two groups in each of the eight parts of this hypothesis.

The results of the t-test on all of the parts of this hypothesis are shown in TABLE 7.

As indicated in TABLE 7, the results of the t-test show that there was not a significant difference between the means achieved by the experimental group and the regular group on any of the eight test sections.

The following results of the t-test were observed when the two groups were compared:

1. Part a - the probability of obtaining a t of 1.43 by chance was found to be 0.17.
2. Part b - this comparison produced identical means of 6.00.
3. Part c - the probability of obtaining a t of 0.79 by chance was found to be 0.43.
4. Part d - the probability of obtaining a t of 0.29 by chance was found to be 0.77.
5. Part e - the probability of obtaining a t of 0.22 by chance was found to be 0.83.

TABLE 7

COMPARISON OF GROUP MEANS ON EIGHT TEST SECTIONS

| Test Sections | Source | Mean | Standard Deviation | t | Probability Two-tail |
|---|---|---|---|---|---|
| 1. | Experimental | 4.97 | 1.48 | 1.43 | 0.17 |
| | Regular | 4.42 | 1.70 | | |
| 2. | Experimental | 6.00 | 1.97 | 0.00 | 1.00 |
| | Regular | 6.00 | 2.33 | | |
| 3. | Experimental | 7.86 | 2.55 | 0.79 | 0.43 |
| | Regular | 7.30 | 3.26 | | |
| 4. | Experimental | 7.17 | 1.68 | 0.29 | 0.77 |
| | Regular | 7.03 | 2.24 | | |
| 5. | Experimental | 6.14 | 1.97 | 0.22 | 0.83 |
| | Regular | 6.03 | 2.20 | | |
| 6. | Experimental | 4.64 | 1.64 | 0.27 | 0.79 |
| | Regular | 4.55 | 1.23 | | |
| 7. | Experimental | 2.86 | 1.48 | 1.87 | 0.06 |
| | Regular | 2.24 | 1.25 | | |
| 8. | Experimental | 3.78 | 1.48 | 0.31 | 0.76 |
| | Regular | 3.67 | 1.51 | | |

6. Part f - the probability of obtaining a t of 0.27 by chance was found to be 0.79.
7. Part g - the probability of obtaining a t of 1.87 by chance was found to be 0.06.
8. Part h - the probability of obtaining a t of 0.31 by chance was found to be 0.76.

All of the above mentioned t values were found to be not significant at the 0.05 level. The null hypothesis was not rejected for all parts of the test.

## SUMMARY

The data used in this study were student scores on the understanding of industry test. The statistical analysis of the data involved comparisons of means among groups of students.

All of the comparisons between mean scores of students in the experimental and regular industrial arts programs indicated that there was no significant difference in their understanding of the selected functions of industry as a result of having taken either program.

The results of the two-way analysis of variance also indicated that the urban-rural effect did not influence the students understanding of industry. Also, the schools the students came from showed no difference when the means were compared.

The understanding of industry test used was composed of questions covering eight selected functions of industry. A comparison of student means on each of these eight functions indicated that neither of the programs gave significant results.

# CHAPTER 5

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

### SUMMARY

The primary purpose of this study was to ascertain the understanding of selected functions of industry by industrial arts students in New Brunswick. It was an attempt to evaluate the understanding students' possessed in relation to the industrial arts objective "to gain an appreciation and understanding of industry."

In conducting this study a comparison was made in order to determine which of the two industrial arts programs currently in operation in New Brunswick junior high schools, the experimental or the regular was more successful in providing students with an understanding of the functions of industry. The comparison of these two programs was done by testing the six null hypotheses which were established in Chapter I (pp. 5-7).

The sample of students selected for testing consisted of 69 grade nine industrial arts students enrolled in New Brunswick junior high schools. These schools were participating in an industrial arts curriculum pilot project during 1972-73. The sample consisted of 36 students who had taken the experimental program and 33 students who had taken the regular program.

When a review of the literature revealed that no suitable test was available for testing junior high school

students' understanding of industry an instrument designed to measure that knowledge was developed for this study. A body of knowledge for industry, as identified by the Association of Consulting Management Engineers (1970) was used to form the basis for developing questions for the test.

A pilot test of 101 multiple choice questions was administered to grade nine students from the Edmonton school system. The data received from this pilot test was used to revise the test and resulted in the final Understanding of Industry Test, which consisted of 80 reverse-multiple choice questions. An analysis of the test instrument indicated a reliability co-efficient of 0.849 as measured by the Kuder-Richardson 20 formula.

SUMMARY OF THE FINDINGS

The scores obtained from the Understanding of Industry test were the data used for the comparisons which were made between the groups of students tested. Appropriate statistical techniques were used to analyze the data and to test the six hypotheses. Hypotheses one to five were tested using a two-way analysis of variance technique and hypothesis six was tested using a t-test. The tests carried out on the data produced the following results.

1. No significant difference was found between the mean scores obtained on the Understanding of Industry test by the students taking the experimental course and the students taking the regular course.
2. No significant difference was found between the

mean scores obtained on the Understanding of Industry test by the students in the urban schools and the students in the rural schools irregardless of the program they were taking.

3. No significant interaction was found between the mean scores obtained on the Understanding of Industry test by the students tested, when the urban school-rural school and the experimental program-regular program effects are considered.
4. No significant difference was found between the mean scores obtained on the Understanding of Industry test by the students in the three schools tested when the effect of the two programs has been removed.
5. No significant interaction was found between the mean scores obtained on the Understanding of Industry test by the students tested, when the three schools and the experimental program-regular program effects are considered.
6. No significant difference was found between the mean scores obtained on any of the eight test sections by the students in the experimental course and the students in the regular course.

## CONCLUSIONS

The reader is reminded that the conclusions drawn from the findings of this study are subject to the limitations established in Chapter I and that any generalizations made from the findings must be made with these limitations in mind.

Also, the Understanding of Industry Test which was developed for this study was based on the functions of industry as defined by the Association of Consulting Management Engineers. The test measured knowledge of organization and management, research and development, production, marketing, personnel administration, finance, external relations, and secretarial and legal affairs.

Within the above mentioned limitations the following conclusions are presented:

1. There is no evidence to suggest that either program, the experimental or the regular, is achieving the understanding of industry objective better than the other.
2. There was no significant difference in the level of understanding of industry between urban and rural students.
3. There is no evidence to suggest that the school in which the students were enrolled had any influence on their understanding of industry.
4. A comparison of the results for each of the eight functional areas covered by the test produced no significant differences.

RECOMMENDATIONS

The following are recommendations which resulted from the findings of this study:

1. Since restrictions placed on the study were such that it was not possible to include a greater

number of students, and since the number of schools offering both programs has been increased, it is recommended that future research would be improved by increasing both the number of schools and the number of students to be tested.

2. The schools used in the study contained only students who had taken industrial arts courses. Hence, it was not possible to utilize a group of non-industrial arts students as a control group. It is recommended that further research in this area make use of non-industrial arts students in order to determine if the knowledge that students have about industry is being realized from exposure to industrial arts courses or from other areas.
3. The interpretation of the objective, understanding of industry, for purposes of this study, was derived from a review of available literature. A further study to determine the interpretation of this objective by industrial arts teachers and representatives of industry in New Brunswick should be used to make research of this nature more meaningful within the province. Along the same lines further research could be conducted in order to determine which of the functions of industry are receiving most emphasis in the planning and teaching of industrial arts courses in New

Brunswick schools.

4. It was not the purpose of this study to conduct a longitudinal study. This type of study would permit the use of a pre-test treatment post-test type of experimental design. This type of design should be used in future research to help determine what content should be included in industrial arts programs in order to achieve the understanding of industry objective.
5. The findings of this study show that the two industrial arts programs investigated can be considered equal with respect to achieving the understanding of industry objective. It is recommended that further comparisons of these two programs could be made in areas such as: a) the remaining course objectives; b) the cost of equipment, supplies, and materials for the two programs; c) the utilization of student time; d) student and teacher interest in the program; e) the methods of instruction used in the two programs.

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# APPENDIX A

# REFERENCES USED IN CONSTRUCTION OF THE UNDERSTANDING OF INDUSTRY TEST


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# APPENDIX B

# OUTLINE OF THE FUNCTIONS OF INDUSTRY USED IN THE CONSTRUCTION OF THE UNDERSTANDING OF INDUSTRY TEST

## ORGANIZATION AND MANAGEMENT

1. Manufacturing organization
   a. Organizing for production
   b. Principles of industrial organization
2. Starting an enterprise
   a. Basic considerations
      1. Need (public and personal)
      2. Profit
   b. Methods of financing
      1. Stocks
      2. Personal monies
      3. Borrowing
3. Types of enterprise
   a. Sole proprietorship
   b. General partnership
   c. Corporation
4. Organizational structure of the enterprise
   a. Managerial
      1. Stockholders
      2. Board of directors
      3. President
   b. Line organization
   c. Staff organization

d. Line and staff organization

B. RESEARCH AND DEVELOPMENT

1. Purpose and function of research and development
   a. Definition of terms
   b. Functions
   c. Methods (product and market research)
2. Types of research
   a. Basic or pure
   b. Applied or practical
3. Development
   a. New product development and product improvement
   b. Advanced development
   c. Product redevelopment for cost reduction
4. Product engineering
   a. Product design
   b. Engineering tests
   c. Factory followups
   d. Sales assistance
5. Development phases
6. Patent for new products
   a. Product audit sheet and audit conference
   b. Facts about new product
   c. Patent survey

PRODUCTION

1. Plant engineering
   a. Utilities design and operation
   b. Facilities design and specifications
   c. Maintenance
   d. Plant equipment control

2. Industrial engineering
   a. Methods study
   b. Plant layout
   c. Work measurement
   d. Materials handling study
   e. Tool, jig, fixture and pattern manufacture and repair
3. Purchasing
   a. Buying
   b. Purchase expediting, records, and files
   c. Purchase research
   d. Salvage sales
4. Production planning and control
   a. Traffic
   b. Factory receiving
   c. Materials procurement
   d. Operation scheduling
   e. Tool, jig, fixture procurement
   f. Production instruction distribution
   g. Dispatching
   h. Production expediting
   i. Performance reporting
   j. Storekeeping
   k. Stores control
5. Manufacturing
   a. Parts manufacture
   b. Sub assembly
   c. Final assembly
   d. Service and repair

6. Quality control
   a. Control methods development
   b. Gage control
   c. Inspection and test
   d. Customer complaints
   e. Salvage

D. MARKETING

1. Market research
   a. Market analysis
   b. Product requirements
   c. Distribution problems
2. Advertising
   a. Campaign planning
   b. Copy presentation
   c. Selection of media
   d. Production of copy
3. Sales promotion
   a. Program development
   b. Sales aides
4. Sales planning
   a. Sales policies
   b. Budgeting
   c. Pricing
   d. Buying
   e. Packaging
5. Sales operations
   a. Procurement, training, and direction of salesmen

b. Compensation for salesmen

c. Selling the customer

6. Product distribution

a. Warehousing

b. Shipping

c. Product service

E. FINANCE AND CONTROL

1. Finance

a. Finance planning

b. Tax management

c. Financial relation

d. Custody of funds

e. Credit and collection

f. Insurance

2. Control

a. General accounting

b. Cost accounting

c. Planning and budgeting

d. Internal auditing

e. Systems and procedures

F. PERSONNEL ADMINISTRATION

1. Employment

a. Recruitment

b. Selection

c. Introduction

d. Promotion and transfer

e. Separation

2. Wage and salary administration
    a. Employee classification
    b. Rate determination
    c. Merit ratings
    d. Supplement compensation
    e. Work schedule control
3. Industrial relations
    a. Communications
    b. Collective bargaining
    c. Employee discipline
    d. Personnel research
4. Organization planning and development
    a. Organization planning
    b. Manpower development
    c. Training
5. Employee services
    a. Medical services
    b. Recreation
    c. Personal services
    d. Safety
    e. Protection and security

G. EXTERNAL RELATIONS

1. Communication and information
    a. Attitude and opinion appraisal
    b. Employee information exchange
        1. Questionnaire
        2. Management

3. Working conditions

c. Creditor and investor communications

1. Stockholders

2. Profit

3. Wages

4. Services

d. Public communications

1. Bulletin boards

2. Letters

3. Magazines

4. Newspapers

2. Public activities co-ordination

a. Civic affairs participation

b. Association and society relations

H. SECRETARIAL AND LEGAL AFFAIRS

1. Secretarial functions

a. Stockholder affairs

1. Agendas

2. Proxy statements

3. Resolutions

b. Board of directors affairs

1. Advise and prepare

i. Agendas and resolutions

ii. Minutes and other records

c. Corporate affairs

1. Prepare reports

2. Maintain legal documents

2. Legal functions
   a. Corporate affairs
      1. Counselling and preparing legal documents
      2. Advising on company matters
   b. Employee affairs
      1. Preparing and counselling on documents
      2. Representing the company with transactions
   c. Financial affairs
      1. Preparing and counselling on documents
      2. Representing the company with transactions
   d. Patent affairs
      1. Counselling on preparing documents
      2. Representing the company with the protection of products

# APPENDIX C

# UNDERSTANDING INDUSTRY TEST

INSTRUCTIONS:

This is a test designed to measure your knowledge and understanding about some important features of industry. The test contains questions about industrial management and organization, research and development, production, marketing, personnel administration, finance, secretarial and legal affairs, and external relations.

This is an untimed test, however, do not spend too much time on any one question. If a question seems too difficult, make the best guess you can, rather than waste time over it. Your score is the number of correct answers you mark.

Each of the questions or incomplete statements in the test booklet is followed by four answere, three of the answere are CORRECT or are the BEST answers. One of the four possible answers is WRONG or the LEAST DESIRABLE. You are to pick out the answer that is WRONG or LEAST DESIRABLE. Mark the space on the answer sheet below the number of the WRONG answer.

Please study the example:

1. The production of automobiles is a major concern of the:

   A. Ford Motor Company
   B. General Motors Company
   C. Imperial Oil Company
   D. Chrysler Motor Company

Mark the answer sheet this way: A___1 B___2 C___3 D___4 E___5

You should mark answer C because it is WRONG, it is the LEAST DESIRABLE answer. ALL of the test items are of the same type. Mark the WRONG answer.

Mark all of your answers on the separate answer sheet. Make your marks with the pencil that is furnished and make them HEAVY and BLACK. If you make a mistake or wish to change an answer, be sure to erase your first choice completely. Be sure to put your name, grade, school and date on the top of the answer sheet.

DO NOT PUT ANY MARKS ON THE TEST BOOKLET!

# UNDERSTANDING INDUSTRY TEST

NOTE:

1. Mark the WRONG or LEAST DESIRABLE answer.
2. Do not mark in this booklet.

QUESTIONS:

1. The main types of company organization are:

   A. Individual proprietorship
   B. Partnership
   C. Corporation
   D. Association

2. The process of managing a company consists of the following functions:

   A. Planning
   B. Organizing
   C. Certifying unions
   D. Controlling

3. The aim of industrial management is to further the aims of industry which are to:

   A. Pay a large return to stockholders
   B. Produce quality products for a lower price
   C. Make a fair, justifiable profit
   D. Increase efficiency

4. Management of industry feels that in the search for efficiency there will result:

   A. Lower prices for consumers
   B. Less mechanization
   C. Rising national income
   D. Higher wages for employees

5. The following methods may be used to raise funds when starting an enterprise:

   A. Sell stocks
   B. Public donations
   C. Personal investment
   D. Borrow money

Mark the WRONG or LEAST DESIRABLE answer.

6. The following are examples of corporations:

   A. General Motors
   B. Moon Palace Restaurant
   C. Imperial Oil
   D. Canadian Pacific Railways

7. The advantages of a line and staff company organization are:

   A. Authority can be delegated to a number of company employees
   B. Company decisions are made by several people
   C. The president maintains close control over the company
   D. The specialities of company personnel are used fully

8. The following are <u>advantages</u> of the partnership type of business organization:

   A. Easily formed
   B. There is more than one owner to provide capital
   C. The partners have direct control over the business
   D. Each partner is responsible for the debts of the business

9. Individual proprietorships are common in:

   A. Retail trade
   B. Agriculture
   C. Manufacturing
   D. Service industries

10. In a company that is organized using a line organization:

   A. Each employee has only one supervisor
   B. The president handles all company problems
   C. The hiring of personnel is done by the personnel manager
   D. There are no staff specialists employed

11. The objectives of research and development are:

   A. To improve existing products
   B. To develop new products
   C. To perform research for the advancement of industry
   D. To improve company profits

Mark the WRONG or LEAST DESIRABLE answer.

12. Pure research is usually carried on by:

A. Universities
B. Government sponsored projects
C. Small business concerns
D. Independent research agencies

13. Applied research has resulted in:

A. Splitting of the atom
B. Development of nylon
C. Fast drying paint
D. Plastic packages for products

14. The following are steps in the development of a new product:

A. Obtaining and screening ideas
B. Technical evaluation
C. Preparation for production
D. Product sales

15. Laws and principles of appearance are necessary in product design. These principles include:

A. Unity
B. Efficiency
C. Interest
D. Balance

16. A product is properly designed for production when it:

A. Is functionally sound
B. Has sales appeal
C. Has a pleasing appearance to management
D. Is competitive in price

17. The following are sources of new product ideas:

A. Accounting Reports
B. Company staff
C. Competitors
D. Government agencies

18. The sales department would be interested in showing a prototype to:

A. Future customers
B. Management of the company
C. Company competitors
D. Company service personnel

Mark the WRONG or LEAST DESIRABLE answer.

19. The following processes are a part of product engineering:

A. Quality control
B. Designing the product parts
C. Building production prototypes
D. Technical writing and illustrating

20. A patent may be obtained by a company for the protection of:

A. A machine
B. A process
C. An improvement to a product
D. A plant location

21. Product research involves:

A. Investigation leading to a product idea
B. Manufacturing the product
C. Solving problems in a products development
D. Obtaining facts on which product decisions are based

22. Market research involves:

A. Studying the design of a product
B. Studying market conditions
C. Studying customer demands
D. Studying competitors activities

23. The following factors are important when locating a new plant:

A. Availability of raw materials
B. Control of inventory
C. Cost of land
D. Available manpower

24. The following processes should be considered when buying equipment and materials:

A. Storing equipment and materials
B. Selecting suppliers
C. Requesting bids from suppliers
D. Analyzing bids

25. These items are important when planning the layout of a manufacturing facility:

A. Product to be manufactured
B. Lighting, heating, ventilation
C. Space requirements for equipment
D. Purchasing materials for the product

Mark the WRONG or LEAST DESIRABLE answer.

26. A purchase requisition should contain:

A. Quantity of material needed
B. Quantity of material in stock
C. Date material is nee[illegible]
D. Size and kind of mat[illegible]oded

27. A production methods study may be performed by a company in order to:

A. Reduce costs to a minimum
B. To improve the product
C. To satisfy union demands
D. To standardize production

28. Materials handling in a plant involves:

A. Sale of materials
B. Movement of materials
C. Packaging of materials
D. Storing of materials

29. In a mass production situation:

A. The work is divided and subdivided
B. Tasks are made simple
C. There is a great need for skilled workers
D. Products are made faster

30. If you visited an industry, that used line or continuous production methods, you could expect to see:

A. Workers situated so that when one operation is finished the next worker is ready for the piece
B. Workers performing portions of a much larger job
C. About equal numbers of workers at rest and at work during any one time
D. Material moving continuously at a uniform rate

31. The following are functions of the manufacturing department:

A. Produce parts
B. Repair tools, jigs, and fixtures
C. Combining parts
D. Produce finished products

Mark the WRONG or LEAST DESIRABLE answer.

32. Products that have been rejected by the quality control inspector can be salvaged by:

A. Using them as if they passed
B. Repairing the defects
C. Selling them for scrap
D. Selling them as seconds

33. A flow chart is used to show the step by step sequence of:

A. Operations performed
B. Movement of parts
C. Maintenance schedule
D. Inspection of parts

34. These are examples of mechanical fasteners:

A. Staples
B. Dowels
C. Bolts
D. Screws

35. Servicing a product involves:

A. Selling
B. Installing
C. Maintaining
D. Repairing

36. These steps are involved in tooling up for production:

A. Deciding what machines, tools, and equipment to use
B. Designing and making special fixtures
C. Advertising the product for sale
D. Supervising the trial run of production

37. The effects of providing a warranty on a product are:

A. Customer satisfaction
B. Gives an edge over competitors in sales
C. Provides a check on product faults
D. Increases the price of the product

38. Advertising layouts can be developed from:

A. Photographs
B. Charts and graphs
C. Drawings and other art work
D. Classified blueprints

Mark the WRONG or LEAST DESIRABLE answer.

39. When advertising a product a company could use:

A. Radio and television
B. Consumer Reports
C. Newspapers
D. Handbills

40. In marketing his product a manufacturer might use the following methods:

A. Direct selling to stores
B. Selling by mail
C. Operating one's own showroom
D. Foreclosure sales

41. In obtaining a customers attitude towards a product a company should consider:

A. Distance from the factory
B. Potential price
C. Design (color, shape, form)
D. Specifications (size, weight)

42. The following points suggest some desirable qualifications of a salesman:

A. Knowledge of the product
B. Fast talker
C. Honesty
D. Ability to meet people

43. The following factors should be considered when designing a package for a product:

A. Function of the product
B. Weight of the product
C. Shape of the product
D. Durable or perishable product

44. In introducing a product on the market a company should consider:

A. Seasonal demands
B. Technical illustrations
C. Current sales trends
D. Product production schedule

Mark the WRONG or LEAST DESIRABLE answer.

45. In promoting the sale of a product the following aides could be used:

A. Kits
B. Displays
C. Government agencies
D. Sample products

46. Market analysis can be used by a company to:

A. Tell who their customers will be
B. Tell where the customers live
C. Tell if the product operates correctly
D. Tell what the customers are interested in

47. A salesman is paid by:

A. Salary
B. Salary and commission
C. Commission
D. Consignment

48. An advertising campaign for a product should tell the potential customer:

A. Where he can get it
B. What it will do
C. The defects
D. The price

49. Accidents in a plant are usually caused by unsafe acts. The following are examples of unsafe acts:

A. Removal of a machine guard
B. Failure to use safety glasses
C. Sweeping up debris
D. Running in the plant

50. The medical services provided by a company could include:

A. Major operations
B. Emergency medical services
C. First aid training
D. Medical examinations of job applicants

51. Merit rating of an employee on the job can involve:

A. The quality of his work
B. His knowledge of the job
C. His position in the union
D. His attendance record

Mark the WRONG or LEAST DESIRABLE answer.

52. A company can train an employee in the following ways:

A. At a company school
B. By the union
C. On the job
D. At a trade school

53. The basic purposes of a strike are:

A. To end a workers length of employment
B. To temporarily stop work
C. To be able to resume work on more favorable terms
D. To bring the employer to terms by causing him financial loss

54. Some personal services that companies provide for employees are:

A. Union facilities
B. Eating facilities
C. Social programs
D. Athletic programs

55. A worker usually leaves a company in the following ways:

A. Retirement
B. Is fired
C. Leaves of his own accord
D. Is promoted

56. The basic purposes for a group of workers to form a trade union are to:

A. Better their wages or working conditions
B. Gain added strength in bargaining
C. Maintain their conditions of employment
D. Gain more job security

57. Promotion in a company may be based on an employee's:

A. Tardiness and absence record
B. Religion record
C. Production record
D. Rating by his superiors

58. Our economy is demanding a higher proportion of people with:

A. Professional and technical skills
B. Manual skills
C. Sales skills
D. Service abilities

Mark the WRONG or LEAST DESIRABLE answer.

59. A company's bookeeping system should provide a record of:

A. Receipts of money
B. Salaries paid
C. Rent and utilities payments
D. Size of the plant

60. A company's accounting department is responsible for:

A. Collecting union dues
B. Keeping a record of money received and issuing bills
C. Keeping a record of money paid out and paying bills
D. Preparing accounting reports

61. The following factors should be considered when granting credit to a customer:

A. Honesty
B. Assets
C. Personal interests
D. Ability to pay

62. Internal auditing in a company involves:

A. Checking payroll accounts
B. Checking inventories
C. Checking financial records
D. Checking product sales

63. Questions to be asked when checking the credit standing of a customer:

A. Will the buyer's wife pay
B. Can the buyer pay as promised?
C. Will he pay?
D. When will he pay?

64. A company should carry insurance to cover such things as:

A. Fire and theft
B. Automobile liability
C. Business failure
D. Workmen's Compensation

65. The following deductions could be made from an employees pay:

A. Income tax
B. Pension payments
C. Insurance payments
D. Finance company payments

Mark the WRONG or LEAST DESIRABLE answer.

66. The following are examples of direct costs of manufacturing a product:

A. Material costs
B. Cost of jigs and fixtures
C. Overhead costs (rent, lights, etc.)
D. Labor costs

67. Some advantages of forming a corporation are:

A. The corporation can own and sell property
B. Easier to raise money than other forms of business
C. Does not depend on one person in order to stay in business
D. Each of the owners is personally liable for company actions

68. The corporation secretary is responsible for:

A. Keeping minutes of meetings
B. Submitting budget reports
C. Publishing the company's annual report
D. Issuing notices of stockholders meetings

69. The activities of a corporation are controlled by:

A. The better business bureau
B. Federal and provincial laws
C. The corporation charter
D. The corporation by-laws

70. Common stock in a corporation:

A. Is more secure than preferred stock
B. Gives the owner voting rights
C. Pays dividends to the owner
D. Can be sold by the owner

71. A company's board of directors is responsible for:

A. Electing company officers
B. Declaring dividends
C. Issuing stock
D. Hiring Employees

72. A company's stockholders have the right to:

A. Elect the board of directors
B. Sell the assets of the corporation
C. Dissolve the corporation
D. Decide where the company products will be sold

Mark the WRONG or LEAST DESIRABLE answer.

73. A patent:

A. May be obtained for a product or idea
B. Is obtained from the federal government
C. May be obtained by a company or an individual
D. Is renewable after it expires

74. A company's annual report provides shareholders with information on:

A. Union activities
B. Financial results
C. Company progress
D. Future plans

75. Some of the benefits of a good public relations program are:

A. Employees are happier
B. Union relations are improved
C. Higher salaries for employees
D. The company attracts better employees

76. The public's feelings towards a company is influenced by:

A. The friendliness, courtesy, and accuracy of it's employees
B. The physical appearance of the company plant
C. The company's annual report
D. The quality of the company's service

77. A company uses various approaches to the public to tell the company's story. Some of the avenues are:

A. Newspapers
B. Magazines
C. Letters
D. Royal commission reports

78. In order for a product to be successful on the market the following people must like it:

A. Salesmen
B. Stockroom managers
C. Advertising personnel
D. Service workers

79. Employees can be kept informed of company plans in the following ways:

A. Company newsletter
B. Company notice board
C. Verbal announcements
D. By radio and television

80. A company can participate in the following civic functions in order to improve its image:

A. Supply speakers for club dinners
B. Sponser political candidates
C. Sponser sporting events.
D. Hold plant tours

Mark the WRONG or LEAST DESIRABLE answer.

# APPENDIX D

# TEST ITEM ANALYSIS FOR

# THE UNDERSTANDING OF INDUSTRY TEST

| ITEM | DIFFICULTY | CORRELATION | RELIABILITY |
|---|---|---|---|
| 1. | 0.26 | 0.35 | 0.15 |
| 2. | 0.75 | 0.22 | 0.09 |
| 3. | 0.54 | 0.45 | 0.22 |
| 4. | 0.42 | 0.32 | 0.16 |
| 5. | 0.59 | 0.44 | 0.22 |
| 6. | 0.91 | 0.36 | 0.10 |
| 7. | 0.36 | 0.14 | 0.02 |
| 8. | 0.29 | 0.22 | 0.05 |
| 9. | 0.43 | 0.51 | 0.25 |
| 10. | 0.14 | -0.18 | -0.06 |
| 11. | 0.52 | 0.10 | 0.05 |
| 12. | 0.72 | 0.37 | 0.17 |
| 13. | 0.52 | 0.31 | 0.16 |
| 14. | 0.59 | 0.47 | 0.23 |
| 15. | 0.19 | -0.03 | -0.01 |
| 16. | 0.41 | 0.42 | 0.21 |
| 17. | 0.32 | 0.37 | 0.17 |
| 18. | 0.64 | 0.69 | 0.33 |
| 19. | 0.36 | 0.13 | 0.06 |
| 20. | 0.58 | 0.58 | 0.28 |
| 21. | 0.68 | 0.29 | 0.14 |
| 22. | 0.46 | 0.55 | 0.27 |
| 23. | 0.67 | 0.58 | 0.27 |
| 24. | 0.38 | 0.51 | 0.25 |
| 25. | 0.39 | 0.44 | 0.21 |
| 26. | 0.41 | 0.52 | 0.26 |
| 27. | 0.52 | 0.49 | 0.24 |
| 28. | 0.09 | -0.05 | -0.01 |
| 29. | 0.54 | 0.34 | 0.17 |
| 30. | 0.71 | 0.30 | 0.14 |
| 31. | 0.61 | 0.26 | 0.13 |
| 32. | 0.81 | 0.42 | 0.16 |
| 33. | 0.49 | 0.47 | 0.24 |
| 34. | 0.72 | 0.33 | 0.15 |
| 35. | 0.67 | 0.60 | 0.28 |
| 36. | 0.59 | 0.56 | 0.28 |
| 37. | 0.62 | 0.26 | 0.13 |
| 38. | 0.36 | 0.21 | 0.10 |
| 39. | 0.30 | 0.22 | |

TEST ITEM ANALYSIS FOR

THE UNDERSTANDING OF INDUSTRY TEST

| ITEM | DIFFICULTY | CORRELATION | RELIABILITY |
|---|---|---|---|
| 41. | 0.80 | 0.55 | 0.22 |
| 42. | 0.88 | -0.10 | -0.03 |
| 43. | 0.62 | 0.61 | 0.30 |
| 44. | 0.36 | 0.30 | 0.14 |
| 45. | 0.77 | 0.35 | 0.15 |
| 46. | 0.25 | 0.20 | 0.08 |
| 47. | 0.71 | 0.46 | 0.20 |
| 48. | 0.84 | 0.70 | 0.26 |
| 49. | 0.83 | 0.20 | 0.07 |
| 50. | 0.65 | 0.49 | 0.23 |
| 51. | 0.64 | 0.58 | 0.28 |
| 52. | 0.80 | 0.77 | 0.31 |
| 53. | 0.54 | 0.58 | 0.29 |
| 54. | 0.27 | 0.31 | 0.14 |
| 55. | 0.70 | 0.43 | 0.20 |
| 56. | 0.43 | 0.41 | 0.20 |
| 57. | 0.84 | 0.51 | 0.19 |
| 58. | 0.39 | 0.19 | 0.09 |
| 59. | 0.88 | 0.29 | 0.09 |
| 60. | 0.65 | 0.60 | 0.28 |
| 61. | 0.49 | 0.45 | 0.22 |
| 62. | 0.20 | 0.17 | 0.07 |
| 63. | 0.75 | 0.45 | 0.19 |
| 64. | 0.35 | -0.06 | -0.03 |
| 65. | 0.68 | 0.44 | 0.20 |
| 66. | 0.58 | 0.22 | 0.11 |
| 67. | 0.26 | 0.43 | 0.19 |
| 68. | 0.25 | 0.21 | 0.09 |
| 69. | 0.43 | 0.25 | 0.13 |
| 70. | 0.36 | 0.35 | 0.17 |
| 71. | 0.42 | 0.65 | 0.32 |
| 72. | 0.33 | 0.19 | 0.09 |
| 73. | 0.51 | 0.08 | 0.04 |
| 74. | 0.52 | 0.59 | 0.29 |
| 75. | 0.39 | 0.31 | 0.15 |
| 76. | 0.59 | 0.21 | 0.10 |
| 77. | 0.72 | 0.33 | 0.15 |
| 78. | 0.39 | 0.39 | 0.19 |
| 79. | 0.68 | 0.75 | |