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THE COMPARISON OF THE COGNITIVE ACHIEVEMENT AND
AFFECTIVE BEHAVIOR OF STUDENTS ENROLLED IN THE
INDUSTRIAL ARTS CURRICULUM PROJECT PROGRAM
WITH STUDENTS ENROLLED IN CONVENTIONAL
INDUSTRIAL ARTS PROGRAMS

DISSERTATION
Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
Larry Reed Miller, B.S., M.Ed.

The Ohio State University
1971

Approved by

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ACKNOWLEDGMENTS

The completion of this evaluation study was possible due to the efforts of many individuals, several of whom I have not had the pleasure of personally meeting. Nonetheless, I am indebted to all of them and would like to acknowledge their efforts at this time.

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CHAPTER I

INTRODUCTION

The mutual dissatisfaction with industrial arts education in the public schools in 1965 drew together a group of professors from The Ohio State University and the University of Illinois for the purpose of generating a better curriculum. The initial efforts of this group resulted in the establishment of the Industrial Arts Curriculum Project (IACP) which was financially supported by the United States Office of Education from June 1, 1965 to August 31, 1971.

Six major undertakings were the central concern of the IACP. These were:

1. Conceptualization of a structure of knowledge in the field of industrial arts.
2. Development of a syllabus for industrial arts.
3. Production of a package of teaching materials.
4. Field testing and revision of teaching materials.
5. Dissemination and field promotion of teaching materials.

Through the accomplishment of these objectives, the project culminated with a two year innovative industrial arts instructional system for the junior high school. Overall the IACP, in developing its products, utilized the research and developmental efforts of
thousands of people at an expenditure of over 2.2 million dollars in public funds.

The Problem

Since its inception in 1965, the IACP had a comprehensive evaluation phase. The central theme of evaluation was to deliniate, obtain, and provide useful information for decision making that would improve the instructional system being produced. However in 1971, with the project nearing completion and final materials to be ready for the 1971-72 school year, the focus switched to product evaluation. In other words, evaluation was being directed toward the collection of evidence that attested the worth of products made available by the IACP. This research study was a major element of the total evaluation effort conducted by the project staff.

Problem Statement

The major problem of this investigation was to compare cognitive achievement and affective behavior of 1) students enrolled in the two year program developed by the IACP in five field evaluation centers, 2) students enrolled in the IACP program in five field demonstration centers, and 3) students enrolled in conventional junior high school industrial arts programs in which the IACP instructional system was not utilized. In addition two related sub-problems were included in this investigation. These were:

1. To determine if there was a relationship between achieve-
ment as compared with intelligence quotient, social position, and geographical location of students enrolled in the two year program developed by the IACP as institutionalized in five field evaluation centers.

2. To compare the achievement of students enrolled in "The World of Construction" course with students enrolled in "The World of Manufacturing" course concerning the total body of knowledge of industry as established in "The Rationale and Structure of Industrial Arts Subject Matter" (Towers, Lux, and Ray, 1966).

Need for the Study

Many innovations have been introduced to the educational community in the past decade. These include such ideas as differentiated staffing, educational parks, systems analysis, national assessment and instructional system packages. Along with this, the quest for accountability has been growing in public education. This means, that while many innovative products are being developed, the purchaser whether it be the school board, superintendent, or teacher, is being pressured by interested publics to be accountable for the public funds being expended. Concerning this problem, Mehrens (1969) states:

Educational decisions must continually be made. As society demands more of education, these decisions become harder and more important. To make these decisions on less information than can be obtained is indeed poor administrative and educational practice (p. 217).
Also, education is becoming increasingly more costly, while financial support of education is more difficult to secure. Therefore objective data that attests the worth of alternatives is a prerequisite to the purchase and acceptance of innovative practices in the public schools today.

The findings of this study will aid educational decision makers in their selection of a relevant industrial arts program in the junior high school.

In addition to the aforementioned need, the study helped serve two objectives of the IACP. These were:

1. The results of this study was included in the evaluation chapter of the project termination report.
2. To provide supportive evidence for financial support by the United States Office of Education or other agencies for future professional activities of the IACP team.

Assumptions

In order to conduct this study, it was necessary to make certain assumptions. These were:

1. The content of the IACP program was different from conventional programs of industrial arts.
2. The World of Construction Achievement Test - Comprehensive Exam measured the cognitive content of "The World of Construction" course developed by the IACP.
3. The World of Manufacturing Achievement Test-Comprehensive Exam measured the cognitive content of "The World of Manufacturing" course developed by the IACP.

4. The Cooperative General Industrial Arts Test measured the cognitive content of conventional junior high school industrial arts courses.

5. The General Scale of Attitudes of Junior High School Industrial Arts measured the degree of positive or negative affect associated with statements pertaining to perceptions of students concerning industrial arts as a subject, future education, and occupational choice.

6. The control variables of intelligence quotient scores and social position scores adjusted for initial differences in the groups of subjects used in this study.

7. The cooperating industrial arts teachers, directors, and supervisors that participated in this study complied with the directions and procedures provided to them by this researcher pertaining to test administration and data collection.

8. The students that participated in this study complied with the test directions pertaining to the test instrument they responded to and answered the test items to the best of their ability.

Limitations

As in any kind of research, it was difficult to control all
phenomena that may have had an impact on the validity of the outcomes of the study. Concerning this problem, four limitations of the study were identified. These limitations were:

1. There was a lack of agreement on what "conventional industrial arts" programs are composed of.

2. Students enrolled in conventional industrial arts programs that participated in this study might have been a biased representation of the total population of students enrolled in conventional junior high school industrial arts programs. The actual selection was made by the field evaluation center directors based on criteria established by the researcher.

3. The study was confined to the measurement of cognitive achievement and gross attitude patterns.

4. The sample was chosen from students that were enrolled in industrial arts at the junior high school or middle school level of education.

Overview of the Study

This study was an ex-post-facto evaluation that compared the cognitive achievement and affective behavior of students enrolled in IACP programs in two operationally different settings (the field evaluation centers and the field demonstration centers) and students enrolled in conventional industrial arts programs. The question of central concern in this effort was:

Is there a difference in achievement and attitude of
students enrolled in the first and second year courses of the IACP program in the field evaluation centers, students enrolled in first and second year courses of conventional industrial arts programs, and students enrolled in first and second year courses of the IACP program in the field demonstration centers?

To provide objective evidence to support answers to the problem of concern, research procedures were established and appropriate research methodology was applied. First a research design was identified and adapted to the study. Following this, sampling procedures were established and the criterion and control variables selected. Data collection, processing, sampling, and analysis techniques were planned, enacted, and controlled. The study was then culminated by completion of this research report which sets forth in later chapters details of the procedures, findings, conclusions, and recommendations concerning the problem underlying the study.

Definition of Terms

The following definitions are given to clarify their usage in the study.

Achievement. As defined by Good (1959), achievement is accomplishment or proficiency of performance in a given skill or body of knowledge (p. 7). For the purpose of this study, achievement was viewed as being synonymous with the score of each subject
in the samples that completed The World of Construction Achievement Test-Comprehensive Exam, The World of Manufacturing Achievement Test-Comprehensive Exam, or the Cooperative General Industrial Arts Test.

Affect. A state of readiness to respond in an accepting or rejecting manner toward a psychological object in accordance with previous conditioning toward or association with the object. For this study, affect was viewed as being synonymous with attitude.

Affective Behavior. Observable responses that depict a degree of acceptance or rejection toward selected psychological objects. The operational definition of affective behavior used in this study was: affective behavior is the score of each subject in the samples that completed the General Scale of Attitudes of Junior High School Industrial Arts.

Cognition. As defined by Good (1959) cognition is the faculty of knowing, especially as distinguished from feeling and willing (p. 107).

Conventional Industrial Arts. Any first year or second year junior high school industrial arts program which does not utilize IACP instructional materials.

IACP. Industrial Arts Curriculum Project—a curriculum development project that has been developing and evaluating a two year junior high school innovative industrial technology education program.

IACP Industrial Arts. As defined by Towers, Lux, and Ray, (1966), IACP industrial arts is an organized study of the knowledge
of practice within that subcategory of the economic institution of society which is known as industry (p. 43).

**Industrial Arts I.** Industrial arts courses that include such conventional subject areas as woodworking, metalworking, electricity, and drawing that are offered to students that have no prior industrial arts education experience.

**Industrial Arts II.** Industrial arts courses that include such conventional subject areas as woodworking, metalworking, electricity, and drawing that are offered to students with one year of prior industrial arts education experience.

**The World of Construction.** An organized study of the knowledge of the study of practice within the subcategory of the economic institution of society known as industry dealing with building things on a site.

**The World of Manufacturing.** An organized study of the knowledge of the study of practice within the subcategory of the economic institution of society known as industry dealing with producing products in a factory or plant.

**Organization of this Research Report**

An introduction, problem statement, need for the study, assumptions, limitations, definition of terms and an overview of the study have been set forth in Chapter I of this report. The overall purpose of this chapter was to introduce the research problem and to present a rationale for conducting the study.

The following chapter will focus on a review of related
literature. Major topics include an overview of the IACP and conventional industrial arts programs, methodology of program evaluation, and related evaluation studies.

Chapter III entitled "Procedure of the Study" details the research method employed which includes a description of the variables of central concern, the measuring instruments, and the control variables. The formulation of hypotheses is also included along with a description of the sampling procedures. The section preceding the chapter summary sets forth the procedures for analysis of the data.

Presentation of the data and analysis of the findings of the study are the central concern of the fourth chapter.

The fifth and final chapter includes a summary of the research report, conclusions based on the findings, and recommendations concerning the study.

The research report is concluded with appendices and a bibliography.
CHAPTER II

REVIEW OF THE LITERATURE

This chapter focuses on the relevant literature concerning the proposed evaluation of cognitive achievement and affective behavior of students enrolled in disparate educational curricula.

The type of research that was employed for this chapter was descriptive in nature. Information for this investigation was obtained by reviewing pertinent literature. Books, doctoral dissertations, and periodicals were key sources of information. The information collected from this library research was analyzed, synthesized, and organized into narrative form to provide an orderly overview of literature related to the major problem of this study. Information for this chapter was obtained from a review of selected literature that was available in the libraries of The Ohio State University and not an exhaustive survey of all literature.

The Industrial Arts Curriculum Project (IACP)

The worth of the IACP instructional system in comparison with conventional industrial arts programs, as measured by the cognitive achievement and affective behavior of students, was the central purpose of this evaluation study. Therefore, due to the relative newness of the IACP program and lack of literature relating to it,
this section of the literature review contains an overview of the IACP and its products.

Formulation of the Rationale for the IACP Instructional System

The initial task of the IACP staff was to conceptualize a structure of knowledge for the field of industrial arts education. As a basis for structuring the knowledge of industrial arts, seven assumptions were made pertaining to industry and education. These were:

1. Industrial arts is a study of industry. It is an essential part of the education of all students in order that they may better understand their industrial environment and make wise decisions affecting their occupational goals.
2. Man has been and remains curious about industry, its materials, processes, organization, research and services.
3. Industry is so vast a societal institution that it is necessary, for instructional purposes, to place an emphasis on conceptualizing a fundamental structure of the field, i.e., a system of basic principles, concepts, and unifying themes.
4. For purposes of analysis, man's knowledge can be logically categorized and ordered.
5. To provide for the most effective and efficient transmission of knowledge, the educator should codify and structure disciplined bodies of knowledge.
6. The structure of a body of knowledge can be developed before the total curriculum is designed.
7. All domains of man's knowledge must be included in an effective general education program (Towers, Lux, and Ray, 1966 pp. 2-3).

Following the establishment of assumptions, the IACP staff proposed four domains in an attempt to taxonomically arrange man's accumulated and recorded knowledge. These domains of knowledge were:

1. Descriptive knowledge as the sciences which establish facts about phenomena and events and described their interrelation.
2. Prescriptive knowledge, as fine arts and humanities which seek to provide a system of values.

3. Praxiological, or knowledge of practice which is concerned with how man acts to accomplish what is valued.

4. Formal knowledge, as the disciplines of mathematics and logic which serve as academic tools (Towers, Lux, and Ray, 1966 pp. 8-10).

An analysis of other industrial arts curriculum proposals and systems of industrial classification were then examined in an effort to identify the source of knowledge for industrial arts. From this analysis, the IACP staff concluded that industrial praxiology is the appropriate concern of industrial arts education. The project staff defined praxiology (synonymous with technology) as the product of the organized, disciplined study of the practices of man (Towers, Lux, and Ray, 1966, pp. 1042).

The task of delimiting industrial praxiology (technology) was undertaken next. Employing Cuber's (1951) five fundamental societal institutions of man as a baseline from which to work (e.g. familial, religious, economic, political and education), the IACP staff chose the economic institution as it functions within society, as an aid in delimiting industrial praxiology. Figure 1 illustrates that the economic institution provides economic goods through material production and other economic activities, such as education, marketing, etc.

In examining this figure, focus should be placed on the subdivision of materials labeled "Industrial" for it was concluded by the IACP that the industrial material production practices of "Construction" (on site production) and "Manufacturing" (in plant production) would be the subject matter of IACP curricula. Based
Economic Institution provides Economic Goods through Material Production.

Material Production

Genetic

Extractive

Industrial

Construction

Manufacturing

Other Economic Activity

Communication

Domestic

Education

Entertainment and Recreation

Finance and Real Estate

Health

Legal

Marketing

Transportation

Miscellaneous

Figure 1. Elements of the Economic Institution.
(Source: Towers, Lux, and Ray, p. 73)
on this conclusion, industry was defined as that part of the economic institution which substantially changes the form of materials to satisfy man's material wants (Towers, Lux, and Ray, 1966, pp. 64-84).

The Taxonomy and Syllabus for Production Practices

Following delimitation of industry as the study of construction and manufacturing, the taxonomy and syllabus of construction production practices was developed by Hauenstein (1966). This was followed by a taxonomy and syllabus of manufacturing practices developed by the IACP staff using similar procedures as developed by Hauenstein. Using a conceptual approach, industry was divided into two categories: 1) that which affects people and 2) that which affect materials.

Figure 2 (First-Order Matrix of Industrial Technology) illustrates that management and production practices provide material goods and affect humans and materials. This matrix is then subdivided as illustrated in Figure 3 (Second-Order Matrix of Industrial Technology Affecting Materials) and Figure 4 (Second-Order Matrix of Industrial Technology Affecting Humans). These matrices illustrate that the major concepts of "production technology", "management technology", and "personnel technology" are common to both construction and manufacturing practices. Although only the first and second matrices are illustrated, it should be noted that the elements were expanded to the third, fourth, fifth, and sixth order as deemed necessary (Towers, Lux, and Ray, 1966, pp. 174-232).
Figure 2. A First Order Matrix of the Technology of the Economic Institution. (Source: Towers, Lux, and Ray, p. 155)
Figure 3. Second Order Matrix of Industrial Technology Affecting Materials. (Source: Towers, Lux and Ray, p. 159)
Figure 4. Second Order Matrix of Industrial Technology Affecting Humans. (Source: Towers, Lux, and Ray, p. 162)
The foregoing subsections have set forth the major ideas of the IACP concerning the conceptualization of a structure of knowledge for industrial arts. Due to the complexity of this undertaking only highlights were included in this chapter. A detailed narrative description of these ideas was set forth in the major product of this endeavor which was a volume entitled "A Rationale and Structure for Industrial Arts Subject Matter" (Towers, Lux, and Ray, 1966).

Development of the Instructional System

After the formulation of the rationale, the IACP staff set out to develop and field test the instructional system. In this regard Buffer (1971) states, "The major objective of the IACP is to develop, refine and institutionalize a new and relevent two year instructional program in industrial arts for junior high school students (p. 1)." This subsection focuses on the development of the IACP instructional system.

The first task was to formulate a schema for putting the structured body of concepts representative of management, production, and personnel technologies into instructional curricula. Factors were identified which might guide the development of course materials. Through the use of a deliniating process, six of these factors were selected by the IACP as essential inputs for the proposed instructional system. These factors were:

1. The taxonomy and syllabus for industrial arts subject matter
2. Desired behavioral changes
3. The nature of the learner
4. School facilities and materials
5. Instructional procedures

Using the knowledge gained in a systematic and thorough analysis of these factors, several conclusions were reached concerning the design of the instructional system:

1. Two one year courses (thirty-six weeks in length) were appropriate to teach the concepts of "The World of Construction" and "The World of Manufacturing"
2. Basic technological concepts would be expanded via a textbook
3. A laboratory manual would be provided for laboratory work
4. A teacher's guide would provide the teacher with basic information for implementing the course
5. Periodic achievement tests would be provided for student evaluation
6. Essential hardware and instructional aids should be provided
7. There would be behavioral objectives for all activities
8. Activities should be representative of each major technological concept
9. The development and field testing of "The World of Construction" would precede the development and field testing of "The World of Manufacturing" by one year to allow for a better work distribution schedule by the IACP staff (Buffer, 1971, pp. 34-35).

The instructional systems were conceived of as having three phases: planning, teaching, and evaluation. To integrate these three concepts, a teaching model (Figure 5) was adapted from the Hough and Amidon Teaching Model (1966). A corollary model was also conceptualized by the IACP staff to guide the development of instructional materials. Figure 6 (Instructional Model) represents this overall structure of the teaching process.
Figure 5. Teaching Process Model. (Source: *The Journal of Industrial Arts Education*, November-December, 1969, p. 19)
Figure 6. Instructional Model. (Source: The Journal of Industrial Arts Education, November-December, 1969, p. 19)
Using this structure as a base, textbooks, laboratory manuals, teacher's guides, and related instructional hardware were developed. To insure an accurate conveyance of technical information, men from industry, business, and labor were contracted as writers and reviewers of manuscripts. These manuscripts were then analyzed, edited, and organized into narrative form by the IACP staff. In addition, laboratory activities were developed by industrial arts teachers that aided the teaching-learning process. These activities focused on 1) the solution of a problem related to a particular concept being presented or 2) practice and application of the concept (Buffer, 1971, pp. 39-58).

Field Testing and Revision of Material

Following the development of the instructional system, the major thrust of the IACP staff was to revise and perfect the instructional materials. To accomplish this, a three year field testing and revision cycle was planned. A series of field evaluation centers, each consisting of four schools, were selected throughout the country to test the IACP instructional system. These field evaluation centers were:

1. Austin, Texas
2. Chicago-Evenston, Illinois
3. Cincinnati, Ohio
4. Dade County, Florida
5. Long Beach, California
6. Trenton-Hamilton Township-New Brunswick, New Jersey
The field evaluation centers were selected to provide as wide a geographic area as possible within the resources of the IACP. Within each center, teachers were selected on the basis of their interest and willingness to utilize the IACP instructional system and cooperate with the IACP staff in field testing the program. During the 1967-8 school year, the Florida, New Jersey and Ohio field centers were used to field test instructional materials. The following school year (1968-9) the other centers in California, Illinois, and Texas were added making a total of six centers involving 48 teachers and approximately 6,400 students using the IACP instructional system (Buffer, 1971, pp. 83-7).

During field testing, information was collected pertaining to five major areas of concern:

1. The completeness and accuracy of subject matter concepts and principles.
2. The time needed for each day's teaching-learning activity—lecture, discussion, laboratory activity and evaluation.
3. The interest factor as it applies to students and teachers.
4. The content level as it relates to students' abilities to read, understand and perform the required assignments.
5. The behavioral changes which are stated to be the objectives of each day (Staff of the Industrial Arts Curriculum Project, 1969, pp. 20-1).

Following the collection of information, the instructional materials were evaluated and areas of weakness were identified and analyzed. Recommendations were then made concerning possible solutions followed by a recycling process of the total instructional system for both "The World of Construction" and "The
World of Manufacturing". In all, both courses were field tests for three years and revised three times (Buffer, pp. 64-71).


Evaluation

The evaluation efforts by the IACP staff were summarized by Buffer (1971) when he stated, "evaluation (of the IACP) was viewed as reflecting all systematic efforts of the project to assess the strengths and weaknesses of its processes and products and their usefulness through measurement of 1) behavior change or goal attainment, 2) the effectiveness of instructional procedures, and 3) the appropriateness of objectives (p. 72)."

As an initial step in developing an evaluation strategy, the IACP staff established a rationale for evaluation. A conceptual framework of possible evaluation questions was structured. This effort culminated with the establishment of a questioning matrix (Figure 7) with three dimensions: instruction, population, and behavior.

Following the development of the questioning matrix, priorities were established concerning specific evaluations. Inputs into this process included the objectives of the IACP, evaluation criteria, methodology, and techniques. From this, an evaluation strategy evolved. Three major components were
Figure 7. Questioning Matrix for IACP Evaluation Endeavors.
identified within the strategy: 1) formative evaluation which focused on the review of manuscript by substantive experts and the classroom tryout of materials, 2) summative evaluation which dealt with the assessment of the instructional system products, and 3) intra-school evaluation which provided data and procedures to aid educational decision-makers regarding the adequacy of the instructional system (Buffer, 1971, pp. 77-82).

Following the identification of the evaluation components, the evaluation rationale was fitted into a logical sequence with the development, revision, and dissemination activities of the IACP. This sequence involved five major phases which are illustrated in Figure 8.

This evaluation study was only one aspect of the total evaluation effort of the IACP. With regard to the questioning matrix, this study focused on the content of instruction as it related to the cognitive and affective behavior of students. In addition, this study was classified as intra-school evaluation in that it provided data that would aid educational decision makers with regard to the adequacy of the instructional system.

The Field Demonstration Centers

In addition to the six evaluation centers previously discussed, the IACP staff established several field demonstration centers. The purpose of these centers was to provide dissemination of the IACP instructional system materials prior to their commercial availability. Through this establishment, an
Figure 8. IACP Model for the Development, Evaluation, and Revision of Instructional Materials. (Source: Buffer, 1971, p. 79)
opportunity was provided to school systems, teachers, teacher educators and other interested publics to examine the products of the IACP being utilized in situations not controlled by the IACP staff. Ten field demonstration centers were established which included 18 teachers and approximately 2,000 students per academic year. The field demonstration centers were Naperville, Illinois; Shawnee Mission, Kansas; Pontiac, Michigan; Minneapolis, Minnesota; Newark, New Jersey; Reno, Nevada; Columbus, Ohio; Worthington, Ohio; Pittsburgh, Pennsylvania; Manassas, Virginia; and Morgantown, West Virginia.

The field demonstration centers were invited to conduct evaluations of the IACP program in their local school systems. These evaluation studies, however, were independent of the IACP evaluation staff activities with the exception of sharing IACP developed tests and research instruments.

Section Summary

The first section of this chapter provided an overview of the IACP; the formulation of the rationale for industrial arts, the development of the instructional system, field testing and materials revision, evaluation strategy of the IACP, and the establishment of the field demonstration centers.

Conventional Industrial Arts

To compare the IACP instructional system with conventional industrial arts curricula, it was deemed appropriate to analyze
and assess the parameters of conventional industrial arts education. This task, at best, was difficult due to variability, rapid change, and philosophical differences associated with industrial arts education. Concerning these problems, Towers, Lux, and Ray, (1966) stated:

**Industrial arts, one of the newer school subjects, has gained popular acceptance and daily is studied by four million pupils in the United States. However, its value is still questioned, partially because of its comparative newness but also because even the specialists in the subject have difficulty in communicating because of the imprecise terms which are in common usage. These specialists are further handicapped, as are students, parents, and others, because their subject matter boundaries remain ill-defined (p. 24).**

Although a consensus of what industrial arts education consists, as thought of by influential people in the profession, is not available, it is possible to gain insight into some of the practices of the industrial arts education profession. Wenig (1970) summarized the status of industrial arts:

**Industrial arts is an accepted part of the total school curriculum. However, it has a lingering public image in its trade orientated subject content. Unfortunately the methods of instruction still are based primarily upon slightly modified traditional approaches of manual training. These traditional approaches include the fabrication of industrial products by means of custom school shop procedures. Even though industrial arts is accepted in the schools, it is criticized for its overuse of job orientated manipulative experiences in the learning situation (pp. 30-1).**

While researching conventional industrial arts programs, two aspects were of central concern: 1) the body of knowledge from which industrial arts draws its subject matter and
The objectives of industrial arts. The remainder of this section focuses on these topics.

The Body of Knowledge for Conventional Industrial Arts

The body of knowledge from which industrial arts derives its subject matter is not well defined. A terse analysis of textbooks and other educational materials reveals that industrial arts educators at the secondary and collegiate level of education have been the usual author of books. For the most part, these publications focus on craft or trade categories (i.e. woodworking, patternmaking, drafting etc.) and the tools, machines, and processes related to these categories. Once the publications are made available, it has not been uncommon for a volume to remain basically unchanged through successive editions over a period of years. In addition, revised textbooks have tended to become encyclopedic in nature in that new information and photographs are added to the text or in a new chapter or section of the book.

The body of knowledge of industrial arts subject matter was categorized by Swanson (1965) into four divisions:

Industrial arts have been visualized as:
1. The study of common life needs created by or related to industrial and technological advance.
2. The study of crafts or trades, processes, tools, machines, materials, and products.
3. The study of application of mathematics and the sciences.
4. The study of industry (p. 47).

It should be pointed out, however, that Swanson established these categories based on his knowledge of both recent curriculum proposals and actual practice by industrial arts educators. In
Practice, the study of trades, processes, tools, machines, materials, and products seems to categorize most industrial art education curricula (Schmitt and Pelley, 1966).

Concerning the industrial arts curricula of the junior high school, Feirer and Lindbeck (1964) stated, "The most typical pattern calls for a general shop course for seventy-two weeks in the seventh and eighth grade, with some opportunity for elective courses in the ninth (p. 30)." These authors also describe the ideal conventional industrial arts program, "A complete program should provide for basic instruction in the areas of drawing and design, power mechanics, electricity, metal-working, graphic arts, woodworking, and industrial crafts (p. 30)."

Schmidt, Harrison, and Pelley (1961) analyzed and compared available state curriculum guides for industrial arts. The results revealed that the guides focused on hand tool and machine operation and reflected little agreement among the states as to what should be taught (p. 21-3).

Another study by Schmitt and Pelley (1966) focused on a survey of industrial arts courses in junior and senior high schools throughout the United States. The results of this study revealed the enrollments and number of schools offering courses under the title of industrial arts. General industrial arts courses which consist of a survey of drafting, metal-working, wood-working, and electricity accounted for 40 per cent of all students enrolled in industrial arts. Another 21 per cent were enrolled in wood-working, 20 per cent in drafting, and 13 per cent in metal-working (pp. 25-6, 116-7). In
other words, 94 per cent of all students enrolled in industrial arts, grades seven through twelve in 1964, were in courses which purported to include the conventional study of materials, tools, and processes which focused on drafting, woodworking, and metalworking. Schmitt and Pelley state, "The entire program of (conventional) industrial arts is predicated upon the factor of direct involvement with materials, tools, and machinery (p. 30."

**The Objectives of Conventional Industrial Arts**

A precise set of statements concerning the objectives of conventional industrial arts is not available. In fact, what constitutes the objectives of industrial arts is a contemporary issue of the profession. Concerning this, Streichler (1966) investigated and reviewed several available research studies. His work reveals the diversity of philosophy and extent of agreement that exists concerning industrial arts objectives. Streichler reported:

1. Miller (1953) discovered that the objectives published by the American Vocational Association in 1953 were favored in 38 state guides. Certain sociological factors of contemporary American society however were not recognized.

2. Hammond (1956) found a diversity of aims and purposes for industrial arts and noted that the objectives of general education were becoming less distinguishable from those of industrial education.
3. Talkington (1962) examined the agreement in the priority of industrial arts objectives between industrial arts teachers in Colorado and 35 selected industrial arts leaders throughout the nation. Agreement was found concerning only one third of the objectives.

4. Woody (1963) in a similar study to the one by Talkington found that there was some agreement using Oklahoma teachers but not enough to suggest unanimity.

5. Hawse (1964) studied the problem of acceptability and recognition of the objectives of industrial arts. He concluded that a basic agreement existed on the value of industrial arts objectives subscribed to by industrial arts teachers in America (pp. 1-3).

A descriptive research effort, similar to the work of Streichler, by Householder and Suess (1969) included three recent studies concerning the objectives of industrial arts:

1. Zullinger (1968) conducted a study of community leaders who ranked the importance of statements about seven facts of industrial education. The respondents indicated that the objectives of industrial arts were not well defined and requested more precise information concerning the goals of industrial education.

2. Backus (1968) was concerned with the relative importance of the objectives of industrial arts.
A Q-sort instrument of statements of student behavior characterizing "ideal" attitudes, concepts, skills, knowledges, appreciations, and values was used. Teachers and administrators rated the importance of the students' behaviors. The outcome of this study was a priority list of nine objectives of industrial arts which included: 1) habits of orderly performance 2) shop skills and knowledge 3) drawing and design 4) appreciation and use 5) health and safety 6) interest in achievement 7) cooperative attitudes 8) self-realization and initiative and 9) interest in industry.

3. Kachel (1967) developed a questionnaire of 130 statements of beliefs and submitted it to a statewide sample of industrial arts teachers, teacher educators, and nationally prominent industrial educators. He reported that the groups were in general agreement on the important objectives and appropriate methods of teaching industrial arts. The responses did not lend themselves to the identification of clear-cut patterns of belief with regard to course content and the industrial arts curriculum, or in the evaluation of student progress. (pp. 7-8)

**Section Summary**

An overview of conventional industrial arts was set
forth in the foregoing section. An examination of the body of knowledge and objectives of industrial arts education as practiced in the United States was of central concern in this section.

Evaluation Methodology

The purpose of this section is to introduce selected aspects of evaluation methodology as it pertains to this study. The researcher does not claim to be an authority of the literature pertaining to the topics covered in this section. An in depth treatise of these topics can be found in the volumes by D'Ambrosio (1970), Dugger (1970), and Fazzini (1970). Subsections include measurement of affective behavior, attitude scales as evaluation instruments, achievement tests as evaluation instruments, and the use of achievement tests in program comparisons.

The Measurement of Affective Behavior

There seems to be many theories or techniques of behavior measurement concerning affect or attitude. Scott (1968) points out that these theories are diverse and are not equally accepted by leading theorists and practitioners in the field of attitude measurement (p. 209). However measures of attitude are identifiable and tend to fall into certain classifications. Cook and Selltiz (1964) state:

We have found it useful to think in terms of five major groupings: a) measures in which the material from which inferences are drawn consists of self reports of belief, feelings, behavior, etc., toward an object or class of objects b) measures in which inferences are drawn from observed
overt behavior toward the object c) measures in which inferences are drawn from individual's reactions to or interpretations of partially structured material relevant to the object d) measures where functioning may be influenced by disposition toward the object and e) measures in which inferences are drawn from physiological reaction to the object. Not all of the measures discussed have been used as attitude tests in the formal sense, but for each of them there is reason to believe that attitudes may be an important determinant of response and thus that the technique could serve as a basis for inferences about attitude (p. 39).

The properties of direction, degree, and intensity of an attitude toward a given object seem to be of central concern in attitude measurement. A study by Cantril (1944) was conducted in an attempt to determine the relationship of intensity and direction of an attitude. From the evidence gathered showing a high interrelationship, Cantril concluded that both degree and intensity appear to measure the affective component of attitude, while the direction is related mainly to cognition (pp. 128-41).

**Attitude Scales as Evaluation Instruments**

There are many methods of measuring attitudes among which include questionnaires, interviews, observation and attitude scales. Of these methods, the attitude scale is probably the most formal and frequently used. Anastasi (1968) points out that attitude scales are used to obtain quantitative measurement of a person's attitude among a unidimensional continuum. Usually the score indicates both the direction and intensity of the individual's feelings toward a company, group of people, policy or other stimulus category (p. 482).
Many types of attitude scales are available for use. Concerning this, Blum and Naylor (1968) have established the following taxonomy:

1. Rating-Scaled Instruments
2. Scaled Item Instruments
   a. Rank Order Scaling
   b. Paired Comparison Scaling
   c. Equal Appearing Intervals and Scales
   d. Successive Intervals Scaling
3. Criterion Group Instruments
   a. Likert Scale
   b. Error-Choice
4. Other Methods
   a. Guttman Scale
   b. Osgood Semantic Scale (p. 294)

Two types of attitude scales, Thurstone's scale and the Likert technique seem to be popular standardized instruments from which many attitude instruments are patterned. Cantril (1944) states, "Thurstone's scales...seem to measure essentially how strongly people like or dislike various social symbols or proposals, while the Likert technique, on the other hand, seems to combine both the intensity and direction (p. 129)." Of these two types of scale construction, the Likert technique seems to be preferred in comparison studies of attitude. Edwards (1957) says, "In terms of research, our interest is in comparing the mean change in attitude scores as a result of introducing some experimental variable...and similarly, if our interest is in comparing mean attitude scores of two or more groups, ...can be done with summated rating scales (the Likert technique)... (p. 196)."

The Likert technique of attitude scale construction
involves a series of statements which are either favorable or unfavorable concerning one or more psychological objects. The responses to these statements are usually listed in five categories: strongly agree, agree, undecided, disagree, and strongly disagree. One way of scoring each statement is to weight the responses five through one with the most favorable attitude receiving the highest score. This method of scoring correlates at a .99 level with more complicated methods (Murphy and Likert, 1937, p. 17).

Achievement Tests as Evaluation Instruments

The achievement test seems to be a widely used evaluation instrument in the field of education. The National Society for the Study of Education, in the 1963 volume entitled The Impact and Improvement of School Testing Programs, states, "...standardized tests have been developed and refined and have proved to be the most promising and helpful instruments to meet the demands for measurement of continuous growth and variability in intellectual personal social development (p. 6)." The American Psychological Association, the American Research Association, and the National Council on Measurement in Education combined to publish Standards for Educational and Psychological Tests and Measurements (1966) in which the following statement is made: "Psychological and educational tests are used in arriving at decisions which may have great influence on the ultimate welfare of the persons tested, on educational points of view and practices, and on development and utilization of human resources (p. 1)."
The Use of Achievement Tests in Program Evaluation

Although the achievement test seems to be widely used and a worthwhile instrument for evaluation, one finds some controversy over its use in evaluating curricula. Tyler, Gagne, and Scriven (1967) are advocates of the proposition that the success of a program can be measured by achievement testing. They state:

Most contemporary evaluations begin and end with achievement testing. A large number of standardized tests are available. Many of these tests have been developed with appropriate attention to the Standards for Educational and Psychological Tests and Manuals (American Psychological Association, 1966) and to such well conceived guidelines as those in Educational Measurements (Lindquist, 1951). It is important to our concern here to emphasize that these tests have been developed to provide reliable discrimination among individual students. Discriminability among students is important for instruction and guidance, but for development and selection of curricula, tests are needed that discriminate among curricula. Different rules for test administration are possible and different criteria of tests development are appropriate, when the tests are to be used to discriminate among curricula (pp. 5-6).

The Educational Testing Service (ETS) also advocates the use of achievement tests in program evaluation. Pertaining to the use of this evaluation procedure, ETS in its 1961 yearbook reports:

One of the more interesting developments in the achievement test area is the way various curriculum study groups are using tests as an integral part of curriculum revision and evaluation of the new course materials. Educational Testing Service has worked closely with five of these groups in recent years: the Physical Science Study Committee, the Biological Sciences Curriculum Study, the Chemical Bond Approach Project, and the School Mathematics Study Group (ETS, pp. 37-38).

From a different viewpoint, Ferris (1962) points out that
the adversaries to the use of achievement tests in curriculum evaluation are in general agreement on two critical points. First, there is a tendency to consider the test results as precise, exact, numerical indices of each student's success in a given course. Second, many tests are used to measure objectives other than those for which the test was constructed to measure (pp. 121-23).

The Use of Achievement Tests in Program Comparisons

One of the more popular evaluation techniques used in making comparisons of two curricula is the collection and analysis of achievement test scores.

One point of view expressed by authorities is that achievement testing is a worthwhile evaluation technique in program comparisons when appropriate methodology and analysis procedures are used. Three methods of program evaluation are suggested by Welch (1968). In reference to the comparative effectiveness of national curriculum projects when compared with conventional programs, Welch states:

"What has been the effect of the national curriculum projects on education in the United States?" Only when this question has been satisfactorily answered can we make intelligent recommendations about future action. In particular, current and future curriculum projects need this information to guide their plans and hopes.

Several different avenues might be followed in assessing the impact of national curriculum projects. For example:
1) by determining the degree of achievement of stated objectives
2) by determining their contribution to general educational objectives
3) by determining the degree to which the course is accepted and used in the schools (Welch, p. 225)
Although in favor of using achievement testing in program evaluation, Cronbach (1963) takes issue with the use of a single evaluation instrument designed to measure the accomplishment of the objective of only one of the programs being evaluated.

Cronbach states:

It is important that this test not stand alone as the sole evaluation device. It will tell us something worth knowing, namely, just how much "conventional" knowledge the new curriculum does or does not provide. The curriculum developers deliberately planned to sacrifice some of the conventional attainments and have nothing to fear from this measurement, competently interpreted (pp. 680-1).

Sullivan (1969) suggests that an effective evaluation design would be to construct a test or tests that sample both the common objectives of the program and the objectives that are unique to each program (p. 86).

Heath (1964) sets forth a practical alternative to Sullivan's technique. Heath states:

Though not the ultimate in curriculum evaluation, a step toward an adequate comparison might be made by using tests for both the conventional and new curricula as achievement criteria (Heath, p. 347).

In support of Heath, Ferris (1962) points out that curricula evaluation studies using multiple achievement tests, of which one is designed for each curriculum, are appropriate. Ferris states:

...comparative studies are being conducted which involve criss-cross testing of control groups and experimental groups using as criterion measures the achievement tests designed for the new curricula as well as traditionally orientated measures of achievement.
These in my opinion, are the common-sense approaches to testing in the new curricula and it is hoped that they will shed more light on the nature of learning in the context of the newly designed course materials (p. 130).

Despite its common use, the achievement test as a comparison instrument has received some criticism from various facets of the educational community. Stake (1967), although not admittedly opposed to curriculum comparisons, points out that standardized tests are important for instruction and guidance of individual students, but not for the development and selection of curricula which require different rules for test administration and different criteria for test development. In reference to the extensive use of achievement testing in curriculum comparisons, Stake says, "I am dismayed by my contemporary colleagues who believe that evaluation of curriculum begins and ends with achievement testing (pp. 5-6)._1

Brownell (1966) in discussing evaluation of learning using dissimilar systems of instruction points out six methodological problems when comparing program A with program B:

1. One can only sample at best a small fraction of the total content.
2. The same content cannot be held constant for any two programs.
3. The amount of emphasis placed on the same objectives varies.
4. The marked dissimilarities in pacing instruction.
5. The variation in teacher practices.
6. The impossibility of controlling the quality of teaching (pp. 80-90).

Heath (1962) concurs with Brownell and points out that pure experimental design can support either curriculum in a comparison
evaluation (p. 216). Heath (1969) further lists several problems associated with curriculum comparisons:

1. It is difficult to find criteria that are relevant to the objectives of both curricula.
2. Neither the experimental nor the control group is likely to represent a homogenous population.
3. If analysis of covariance is used to test hypotheses, the necessary assumptions about regression effects are likely to be untenable.
4. Both students and teachers are likely to be selectively assigned to curricula (Heath, 281).

Section Summary

The foregoing section sets forth selected aspects of evaluation methodology relevant to this study. Topics included measurement of affective behavior, attitude scales as evaluation instruments, achievement tests as evaluation instruments, and the use of achievement tests in program comparisons.

Program Comparison Research Studies

In this section, curriculum comparison studies will be briefly summarized with emphasis placed on methods and procedures as they relate to curriculum comparison theory.

Several studies have been done that attempt to compare the effectiveness of two different programs. Many of these studies focus on disciplines other than industrial arts.

Hipsher (1961) compared the relative effectiveness of the traditional high school physics curriculum and the physics curriculum developed by the Physical Science Study Committee (PSSC). In this study the achievement of 109 male seniors, after completing one year of PSSC physics, was compared with the achievement of 99
male seniors completing a traditional program of physics. The Cooperative Physics Test, designed to measure understanding of traditional physics objectives, served as the criterion variable. Analysis of covariance was the statistical technique used. Four variables 1) scholastic aptitude, 2) prior achievement in natural science, 3) physical science aptitude, and 4) socio-economic status were statistically controlled.

In reporting the results of the study Hipsler (1961) stated:

...students, taught physics using the traditional high school physics curriculum, performed significantly better on the Cooperative Physics Test than students taught high school physics using the curriculum developed by the Physical Science Study Committee (p. 37).

However in discussing the results, Hipsher acknowledged that the instruments used were designed for the purpose of measuring achievement in traditional physics curricula and were therefore inadequate to measure the objectives of the PSSC curriculum (p. 37).

Heath critically analyzed several studies similar to Hipsher's (1961) study and concluded that inappropriate experimental techniques were being employed. Heath (1964) states:

Now courses have been introduced in such variety and in such a relatively brief span of time, that reports of comparative evaluation have not always been available to school authorities. Some published comparison studies have seemed to manifest fundamental flaws in experimental design. For instance, a study reported by W.L. Hipsher ("Study of High School Physics Achievement," Science Teacher, XXVII, 1961, pp. 37-44) compared the achievement of students in the Physical Science Study Committee course with achievement of students in a conventional
Wimburn (1963) reported an evaluation study that was conducted in 1961-2, concerning achievement of approximately 20,000 students using curriculum materials developed by the Biological Sciences Curriculum Study (BSCS). In this study, three tests were used to gather data: one was designed to measure understanding of scientific principles and scientific reasoning capability, the second was designed to measure specific knowledge of the course materials, and the third test was a measure of conventional biology knowledge. A matched-schools control group of 3,944 students was selected from schools which were not using any BSCS materials. An analysis of covariance was used as the statistical treatment. The results of the study revealed that the BSCS students outperformed the control group on the scientific principles and scientific reasoning test and on the BSCS comprehensive examination while the control group excelled on the traditional test.

In a similar comparison study Lessinger (1962) analyzed achievement of students in PSSC physics with students taking conventional physics courses. Concerning the criterion variables, Lessinger states, "Two...tests were used; the Physical Sciences Study Committee Tests published by the Educational Testing Service to sample progress in the new material, and a difficult test produced by the teachers of the district to
check pupil understanding of concepts and facts covered in the traditional physics course (p. 98)." Lessenger concluded that 1) the PSSC students "were not penalized" in learning conventional physics knowledge and 2) the achievement test performance indicated that the PSSC curriculum and the conventional program were at about the same level of difficulty.

Heath (1964) compared the achievement of 1,027 students taking PSSC physics with the achievement of 2,110 students enrolled in traditional physics programs. Four dependent variables were used: an achievement test designed to measure the objectives of PSSC physics, a test designed to measure achievement of objectives of traditional physics, and two aptitude tests. Correlation and analysis of covariance were used as statistical measures. Based on the analysis of data, Heath concluded:

1. PSSC classes perform substantially better on the PSSC Final Examination than did classes in conventional courses.
2. Conventional classes achieved a slightly higher average score on a traditional test than PSSC classes.
3. PSSC classes acquired the cognitive style measured by the Concealed Figures Test to a greater degree than the conventional classes.
4. This cognitive style is related to the achievement scores of the PSSC classes, on both criterion tests. In the control group, this "use of objects in a new way" is not related to achievement on the traditional test (p. 348).

Braden (1964) conducted a study to determine if there was a difference in the effects of the Physical Science Study Committee
(PSSC) physics program and traditional physics programs on student achievement in general college physics as measured by their grades in college physics. His results indicated that no significant differences were found.

Several evaluation studies have been conducted in the field of industrial education. Maley and Mietus (1969) reported the evaluation activities of the Cluster Concept Project which focused on job entry training in high school. One evaluation conducted by the project staff dealt with an experimental comparison of the innovative program with a control group. The major test instruments used to measure cognition and affective behavior included an achievement test developed by the project and the Minnesota Vocational Interest Inventory. The findings of the study revealed no significant difference of the overall group comparisons.

Anderson and Olstad (1971) set forth an overview of the evaluation efforts of the American Industry Project (AIP). Included was a comparative study of the achievement of students enrolled in the AIP with a control group. The findings in general were significantly different in favor of the AIP students.

Two research endeavors are of particular importance to this study. Both focus on evaluation of the IACP utilizing data obtained from students.

Fazinni (1970) conducted a study which focused on attitudes toward the manufacturing industry. Three treatment groups, the IACP "World of Manufacturing," conventional industrial arts and
no industrial arts, were compared using a 53 item attitude scale. Analysis of covariance was the statistical procedure used to test the hypotheses.

Based on the data, Fazzini found a significant difference in attitudes toward manufacturing industry among the three groups. The adjusted mean score of the conventional program was highest, that of the control group next, and that of the IACP group lowest. Fazzini concluded:

1. The fostering of positive attitudes is an attainable objective for industrial arts.
2. The conventional method of teaching is more successful in fostering positive attitudes toward manufacturing industry than the IACP "World of Manufacturing" (pp. 118-21).

Dugger (1970) compared IACP students with traditional industrial arts students using achievement performance on the "General Industrial Arts Test" produced by the Educational Testing Service and the "World of Construction Comprehensive Examination" developed by the IACP staff. The study was conducted in the Columbus, Ohio area using a total of 288 junior high school students enrolled in the IACP field demonstration center, students enrolled in a traditional industrial arts program, and a control group of non-industrial arts students from area parochial schools. Analysis techniques employed for testing the hypotheses included the "t" ratio and stepwise multiple regression analyses. Dugger found:

1. The results of the World of Construction Comprehensive Examination II revealed that the IACP students achieved at a significantly higher level than the traditionally-taught industrial arts
2. The students in the traditional industrial arts program did not perform significantly different from the non-industrial arts student and the IACP students on a national test that was designed specifically for traditional industrial arts subject matter (p. 110).

3. From the data analyzed, The World of Construction Comprehensive Examination did an excellent job in measuring IACP achievement (p. 110).

4. Conversely, the General Industrial Arts Test did not appear to discriminate between the achievement levels of the three groups of students involved in this study (p. 111).

Dugger concluded that the IACP program merited recognition as a successful educational curriculum innovation. This proposed study will attempt to bear out Dugger's findings using a much larger sample (including all of the IACP field evaluation and demonstration centers) and two added dimensions: "The World of Manufacturing" program and a criterion variable to measure attitude.

Chapter Summary

The purpose of this chapter was to set forth a conceptualized review of literature related to this study. To accomplish this, four major topics were identified.

The first topic, an overview of the Industrial Arts Curriculum Project dealt with the formulation of the rationale for the IACP instructional system; the taxonomy and syllabus for production practices; the development, field testing, and revision of the instructional system; the evaluation efforts of the project; and
the establishment and purpose of the field demonstration centers.

The section revealed several points which are noted below:

1. Initial efforts of the IACP focused on the research and development of a rationale and structure of industrial arts subject matter.

2. The IACP has developed a two year innovative industrial arts instructional system for junior high school industrial arts students.

3. Field evaluation centers were established throughout the United States in order to field test the instructional system.

4. A three year comprehensive field testing and revision process was used to validate and refine the instructional system.

5. Two one year instructional packages, "The World of Construction" and "The World of Manufacturing," including instructional software and hardware were the major products of the IACP.

6. A comprehensive evaluation system was utilized in all research, development, and diffusion efforts of the IACP.

7. This study comprised one aspect of the total IACP evaluation endeavors.

8. Several field demonstration centers were established to provide practitioners an opportunity to utilize
and test the instructional system prior to its commercial availability.

An overview of what constitutes conventional industrial arts was the second topic of the chapter. The body of knowledge and objectives for conventional industrial arts were subtopics of this section. Major ideas of this section include:

1. In practice, industrial arts in the United States is comprised of a study of selected tools, materials, and processes of industry.

2. A majority of industrial arts courses focus on drafting, metalworking, and woodworking topics.

3. The objectives or aims of industrial arts education are not well defined and not emphasized uniformly by the practitioners and theoreticians in the field.

The third topic centered on evaluation methodology as it pertains to this study. Subtopics included measurement of affective behavior, attitude scales as evaluation instruments, achievement tests in program evaluation and program comparison studies. The following points were set forth in this section:

1. The properties of direction and intensity are of central concern in measurement of affective behavior.

2. The Likert technique of attitude scale construction allows for the measurement of intensity and direction of attitudes and is used in developing standardized attitude scales.
3. Achievement tests are acceptable instruments in evaluation studies dealing with program comparisons.

4. Several methodological problems were identified pertaining to this study.

The last topic focused on several program comparison research studies. Of particular concern were the methodology and findings of the authors reviewed. This section revealed:

1. Several studies of program comparisons using student achievement and attitude as variables have been made.

2. Two studies were reviewed that directly relate to the purposes and intent of this study.
CHAPTER III

PROCEDURE OF THE STUDY

The purpose of this chapter is to set forth the methods and procedures used in this evaluation study. The first section will introduce the variables and detail the research design of the study. The variables of central concern will be detailed in the second section. This will be followed with an explanation of the four test instruments and two control variables. The formulation of hypotheses and procedures for sampling also make up sections of the chapter. The last section focuses on the data analysis procedures of the study. The chapter is concluded with a summary.

Research Method

For this evaluation study, a post test-only method was used with intact classroom groups. The study was concerned with six groups: four groups which were enrolled in IACP courses and two groups which were enrolled in conventional industrial arts programs. Variables investigated in this study were adjusted statistically by using analysis of covariance. This statistical procedure was used for the purpose of adjusting data for the three groups to control for any initial variations existing in known factors related to the variables under study.
Research Variables

The germane research variables were divided into three classifications: variables of central concern, test instruments, and control variables.

The variables of central concern of the study were:

1. The two year instructional program developed by the IACP and operationalized within the field evaluation centers. This program was divided into two levels:
   a. "The World of Construction" was level one and is referred to by the symbol $X_1L_1$
   b. "The World of Manufacturing" was level two and is referred to by the symbol $X_1L_2$

2. The two year instructional program developed by the IACP and operationalized within the field demonstration centers. This program was divided into two levels:
   a. "The World of Construction" was level one and is referred to by the symbol $X_2L_1$
   b. "The World of Manufacturing" was level two and is referred to by the symbol $X_2L_2$

3. The two year junior high school conventional industrial arts programs located in or about the geographic area of the IACP field evaluation center. For this study these programs were divided into two levels:
a. "Industrial Arts I" was level one and is referred to by the symbol $X_3L_1$

b. "Industrial Arts II" was level two and is referred to by the symbol $X_3L_2$

Four test instruments were used in the study to measure the variables of central concern. These were:


2. The World of Manufacturing Achievement Test-Comprehensive Exam, Third Edition, 1971, IACP. It will be referred to by the symbol $T_2$.

3. Cooperative General Industrial Arts Test, Form A, 1969 Educational Testing Service. It will be referred to by the symbol $T_3$.

4. General Scale of Attitudes of Junior High School Industrial Arts, developed by Miller and Buffer (1971). It will be referred to by the symbol $T_4$.

Scores obtained for two variables were used to adjust for initial differences in groups. These were:

1. The subjects' intelligence quotient scores. The I.Q. scores will be referred to by the symbol $C_1$. 

2. The subjects' index of social position. The index will be referred to by the symbol \( C_2 \).

**Research Design**

The research design used in this evaluation study was a modified version of the "Static-Group Comparison" set forth by Campbell and Stanley (1963). Concerning the purpose of this design Campbell and Stanley stated:

This is a design in which a group which has experienced \( X \) is compared with one which has not, for the purpose of establishing the effect of \( X \).

\[
\begin{array}{c|c}
\hline
X & 0 \\
\hline
- & 0 \\
\end{array}
\]

Instances of this kind of research include, for example, the comparison of school systems which require the bachelor's degree of teachers (the \( X \)) versus those which do not; the comparison of students in classes given speed-reading training versus those not given it; the comparison of those who heard a certain TV program with those who did not, etc. (p. 72).

To adapt this design for use in this study several experimental groups were added as illustrated below:

\[
\begin{array}{c|c}
\hline
X_{1L1} & 011 \\
\hline
X_{1L2} & 012 \\
\hline
X_{2L1} & 021 \\
\hline
X_{2L2} & 022 \\
\hline
X_{3L1} & 031 \\
\hline
X_{3L2} & 032 \\
\end{array}
\]

Analysis of covariance was used to reduce error that might occur using this design and to obtain unbiased estimates of the
measures of the variables of central concern. This procedure involves measuring one or more control variables along with the measures of the variables of central concern. The control variable represents a source of variation that has not been controlled in the study and is believed to affect the variables of central concern.

Variables of Central Concern

In this section the general characteristics of the curricular framework for each of the groups of subjects used in the study are described.

"The World of Construction"--IACP Field Evaluation Centers

"The World of Construction" was a one year introductory innovative industrial arts course, proposed for seventh grade students, which focused on the three major dimensions of construction technology: 1) Construction Management Technology, 2) Construction Production Technology, and 3) Construction Personnel Technology. The instructional system included a textbook, laboratory manual, teacher's guide, achievement tests, and related instructional visual materials and hardware.

Concerning the course activities, Buffer (1971) stated:

While engaged in a study of "The World of Construction," students will learn how bridges, dams, roads, tunnels, and buildings are produced by a managed-personnel-production system. The importance of construction management is emphasized by activities ranging from the preparation of drawings and an estimation of construction costs to the testing of soil and the hiring of construction personnel. Students become familiar with production and service practices by building parts of
structures, by placing concrete, assembling steel beams, laying bricks, installing electrical circuits, plastering walls, and by many other representative activities. Students also design, plan, and build a model house and engage in city and regional planning (p. 2).

"The World of Construction" field evaluation center teachers were paid a modest honorarium by the IACP while the instructional system was being field tested and revised during the 1967-8, 1968-9, and 1969-70 academic years. The teachers' major work responsibilities were to field test the instructional system without modification and to provide feedback and recommendations for revision of laboratory activities and instructional materials.

The expenses for the instructional system in the field evaluation centers, were for the most part met by the IACP during the revision cycle. However, after the instructional system was made commercially available at the beginning of the 1970-71 academic year, the local school systems defrayed the program costs.

"The World of Construction"—IACP Field Demonstration Centers

"The World of Construction" as operationalized in the field demonstration centers was similar to "The World of Construction" operationalized in the field evaluation centers in that the same instructional system was used. However, it was different in that the teachers were not under contract with the IACP and therefore had more freedom to utilize and adapt the instructional materials as they saw fit.

Along with this, the field demonstration teachers had much less involvement with the IACP central staff and had no revision
and feedback responsibilities. Also, the IACP program costs for the field demonstration centers were totally the responsibility of the local school system.

"The World of Manufacturing"--IACP Field Evaluation Centers

"The World of Manufacturing" was a one year innovative industrial arts course designed for eighth grade students and was recommended as the second year IACP sequential course following "The World of Construction." The instructional content was divided into 1) Manufacturing Management Technology, 2) Manufacturing Production Technology, and 3) Manufacturing Personnel Technology. The course was summarized by Buffer (1971) when he stated:

A study of "The World of Manufacturing" is concerned primarily with developing an understanding of how the managed-personnel-production system produces and services manufactured goods. Students become familiar with the manufacturing systems common to all manufactured goods through the study of planning, organizing, and controlling representative production systems. Activities include researching, designing, and engineering of products and processes to produce manufactured goods. Students also become familiar with occupations, materials, tools, and various production processes. They produce goods using custom, job, and continuous production techniques. As a result of manufacturing a variety of different products, students will know how a managed production system affects human and material resources to produce products. Students' activities represent the industrial technologies (practices) common to the manufacture of any product (pp. 2-3).

During the study, "The World of Manufacturing" course was in the third and final year of the development and revision cycle.
As such, the field evaluation teachers were employed by the IACP to aid in the revision process.

The teachers' major concern was to employ, observe, and provide feedback concerning the effectiveness, efficiency, accuracy, and utility of the instructional system. The instructional materials were similar in design to the construction materials.

"The World of Manufacturing"--IACP Field Demonstration Centers

The instructional system used in the demonstration centers for "The World of Manufacturing" was identical to that used in the field evaluation centers. However, as explained earlier, the demonstration center teachers were under no obligation to the IACP to use the instructional system without modification. The teachers were, however, required to complete an IACP sponsored teacher preparation workshop prior to utilizing the instructional system. Also, the costs of the program were the responsibility of the local school system.

Industrial Arts I and II

For the purposes of this study, Industrial Arts I was defined as courses that included such conventional subject areas as woodworking, metalworking, electricity, and drawing that were offered to students that had no prior industrial arts education experience. Industrial Arts II was defined as courses that included such conventional subject areas as woodworking, metalworking, electricity, and drawing that were offered to students with one year of prior industrial arts education experience. These definitions were
formulated in view of the finding of Schmitt and Pelley (1966) concerning the status of industrial arts education in the United States as reported in Chapter II. The operational definitions of conventional industrial arts were structured to correspond with "The World of Construction" and "The World of Manufacturing" in that these innovative courses were designed to be offered to students that had no prior or one year prior industrial arts education experience, respectfully.

The evaluation design called for the utilization of three classes being taught by each "manufacturing" and "construction" teacher and four conventional industrial arts teachers in each field evaluation center. Therefore, due to the working knowledge of the operations of the field evaluation center and surrounding school systems, cooperation of the six field evaluation center directors was sought and received to identify and coordinate the evaluation tasks of the conventional programs for this study.

Five criteria were established by the researcher that were to be used by the field evaluation center directors in selecting the schools offering conventional industrial arts programs for this evaluation study. Two schools from each center were selected from each center that would:

1. Offer a two year industrial arts program (including required and elective courses) at the same grade level as the IACP construction and manufacturing courses.
2. Have at least 3 classes of students enrolled in a first year program at the same grade level as the IACP construction course. Preferably the 3 classes should be taught by the same teacher.

3. Have 3 classes of students enrolled in a second year industrial arts program at the same grade level as the IACP manufacturing course. Preferably the 3 classes should be taught by the same teacher.

4. Consist of students of similar socioeconomic status as the schools offering the IACP program.

5. Have teachers that were willing to cooperate and would be a professional asset to the study.

These criteria were completely carried out in a professional manner by the field evaluation center directors to the satisfaction of this researcher.

The distribution of conventional industrial arts classes from which data were collected is illustrated in Table 1. There was a total of 58 classes involved, of which 26 were classified by the teachers as being primarily general shop courses of one year duration, 13 as woodworking courses, 14 as metalworking, and 5 classified as being primarily drafting courses of one year in duration.

The Test Instruments

The purpose of this section is to set forth a description of the four instruments used in this evaluation study to measure
## TABLE 1

**DISTRIBUTION OF CONVENTIONAL INDUSTRIAL ARTS CLASSES BY LEVEL FROM WHICH DATA WAS COLLECTED**

<table>
<thead>
<tr>
<th></th>
<th>Industrial Arts I</th>
<th>Industrial Arts II</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Shop</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>Woodworking</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Metalworking</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Drafting</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>
the variables of central concern. The selection of instruments was made by the evaluation staff of the IACP for the researcher for this study.

**The World of Construction Achievement Test**

The achievement test selected as the appropriate instrument in measuring the body of knowledge of "The World of Construction" was the fourth edition of The World of Construction Achievement Test-Comprehensive Exam. This test instrument was copyrighted in 1970 by The Ohio State University Research Foundation and was commercially produced by the McKnight and McKnight Publishing Company, Bloomington, Illinois. A copy of this test is contained in Appendix A of this research report.

The test instrument was designed and developed by the IACP as part of its instructional system. The design of the instrument was based on a table of specifications that provided an overall scheme for identifying and writing items that tested the intermediate objectives of "The World of Construction" course. The test instrument was field tested for three years and consequently revised three times according to feedback and test analysis and changes in course materials.

The test instrument contains fifty, four-option multiple choice questions. Summary statistics are illustrated in Table 2. These statistics were derived from answer sheets returned for this study from 310 "Construction" students completing the test in May 1971. The mean for the instrument was 26.41 and the test has
<table>
<thead>
<tr>
<th>Summary Statistics of the World of Construction</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Achievement Test - Comprehensive Exam</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Fourth Edition, 1970</strong></td>
<td></td>
</tr>
<tr>
<td>Number of Items on Test</td>
<td>50.0</td>
</tr>
<tr>
<td>Number of Students in Sample</td>
<td>310.0</td>
</tr>
<tr>
<td>Median</td>
<td>25.0</td>
</tr>
<tr>
<td>Mode</td>
<td>13.0</td>
</tr>
<tr>
<td>Mean</td>
<td>26.41</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>11.01</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.17</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-1.04</td>
</tr>
<tr>
<td>Range</td>
<td>45.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>49.0</td>
</tr>
<tr>
<td>Minimum</td>
<td>4.0</td>
</tr>
<tr>
<td>Reliability Estimates</td>
<td></td>
</tr>
<tr>
<td>Kuder-Richardson formula 20</td>
<td>0.92</td>
</tr>
<tr>
<td>Kuder-Richardson formula 21</td>
<td>0.92</td>
</tr>
<tr>
<td>Mean Item Difficulty</td>
<td>0.47</td>
</tr>
<tr>
<td>Mean Item Discrimination</td>
<td>0.55</td>
</tr>
</tbody>
</table>
a standard deviation of 11.01. A reliability estimate of 0.92 was affixed the test using Kuder-Richardson formula 20. The instrument had a mean item difficulty of 0.47 and mean item discrimination of 0.55.

**The World of Manufacturing Achievement Test**

The World of Manufacturing Achievement Test-Comprehensive Exam was selected as the instrument for measuring the knowledge of "The World of Manufacturing" course. The third edition (1971) of this instrument was used. Like the World of Construction Achievement Test, this test instrument was designed and developed by the IACP and was field tested and revised three times. The instrument is contained in Appendix B of this research report.

The instrument contains fifty, four-option multiple choice questions. The mean for the test, derived from a sample of 255 "Manufacturing" students that completed the test in May 1971, was 22.0 with a standard deviation of 8.13. The reliability estimate using the Kuder-Richardson formula 20 was 0.85. The mean item difficulty was 0.56 and the mean item discrimination was 0.39. Table 3 contains a complete list of the summary statistics for The World of Manufacturing Achievement Test-Comprehensive Exam.

**Cooperative General Industrial Arts Test**

The test selected as an appropriate instrument in measuring the achievement of conventional industrial arts subject matter was the Cooperative General Industrial Arts Test-Form A. This instrument is one of a battery of five tests in the Cooperative
TABLE 3
SUMMARY STATISTICS FOR THE WORLD OF MANUFACTURING
ACHIEVEMENT TEST - COMPREHENSIVE EXAM
THIRD EDITION, 1971

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Items on Test</td>
<td>50.0</td>
</tr>
<tr>
<td>Number of Students in Sample</td>
<td>255.0</td>
</tr>
<tr>
<td>Median</td>
<td>21.0</td>
</tr>
<tr>
<td>Mode</td>
<td>29.0</td>
</tr>
<tr>
<td>Mean</td>
<td>22.0</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>8.13</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.14</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.67</td>
</tr>
<tr>
<td>Range</td>
<td>40.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>42.0</td>
</tr>
<tr>
<td>Minimum</td>
<td>2.0</td>
</tr>
<tr>
<td>Reliability Estimates</td>
<td></td>
</tr>
<tr>
<td>Kuder-Richardson formula 20</td>
<td>0.85</td>
</tr>
<tr>
<td>Kuder-Richardson formula 21</td>
<td>0.83</td>
</tr>
<tr>
<td>Mean Item Difficulty</td>
<td>0.56</td>
</tr>
<tr>
<td>Mean Item Discrimination</td>
<td>0.39</td>
</tr>
</tbody>
</table>

This instrument was the only test identified, in a staff search of available standardized tests, that met the IACP specifications of grade level, content, and cost for this evaluation study. The test was designed to measure technical knowledge and problem solving ability in the content areas of drawing, electricity and electronics, metalworking, woodworking, general industrial arts and practices of industry. The instrument was designed for use by seventh, eighth, and ninth grade students after completion of at least one year of industrial arts education.

The test instrument contains fifty, four-option multiple choice questions. Summary statistics as reported by the Educational Testing Service are reported in Table 4 of this research report. The mean for the combined grade levels was 30.5 with a standard deviation of 7.8. The Kuder-Richardson formula 20 reliability estimate was 0.85. The complete test instrument is contained in Appendix C of this research report.

General Scale of Attitudes of Junior High School Industrial Arts

The scale selected to measure attitudes of students for this study was the General Scale of Attitudes of Junior High School Industrial Arts. The attitude scale was designed and developed by Miller and Buffer (1971) primarily for this evaluation study. The initial step in its construction was the development of a table of specifications that provided an overall plan for
### TABLE 4
SUMMARY STATISTICS OF THE COOPERATIVE GENERAL INDUSTRIAL ARTS TEST-FORM A (ETS, 1969)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number of Students</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Reliability Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seventh Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>90.0</td>
<td>26.6</td>
<td>6.1</td>
<td>0.82</td>
</tr>
<tr>
<td>Eighth Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>350.0</td>
<td>30.6</td>
<td>8.1</td>
<td>0.84</td>
</tr>
<tr>
<td>Ninth Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>660.0</td>
<td>31.0</td>
<td>7.6</td>
<td>0.84</td>
</tr>
<tr>
<td>Seventh, Eighth, and Ninth Grades Combined</td>
<td>36.0</td>
<td>30.5</td>
<td>7.8</td>
<td>-0.19</td>
</tr>
</tbody>
</table>
identifying and writing statements for the scale. Using the table of specifications as a guide, a list of statements were collected and edited and pilot tested using a student sample in the Columbus, Ohio area. The attitude scale was then scored; item-consistency and reliability was analyzed; inconsistent items were eliminated; and a revised attitude scale was prepared for this study.

The General Scale of Attitudes of Junior High School Industrial Arts is a sixty item, five-option multiple choice statements which utilizes the Likert technique as explained in Chapter II for the development of distractors for each statement. The attitude scale is contained in Appendix D of this research report.

The attitude scale, when scored, provided a total score and six sub-scores for each of the sub-scales in the instrument. These sub-scales were:

1. Attitude toward the course as a worthwhile school subject (items 1 through 14).
2. Attitude toward the conceptual structure of industry as conceived by the IACP (items 15 through 20).
3. Attitude toward various purposes of industrial arts education (item 21 through 25).
4. Attitude concerning the importance of industrially related occupations (items 26, 28, 30, 32, 34, 36, 38, and 40).
5. Attitude concerning the image of industrially related occupations (items 27, 29, 31, 33, 35, 37, 39, and 41).
6. Attitudes that focus on Occupational and Educational Operations (items 42 through 60).

Summary statistics for the General Scale of Attitudes of Junior High School Industrial Arts are illustrated in Table 5. The attitude scale mean derived from a sample of 150 students that completed the scale in May 1971 was 206.45 with a standard deviation of 19.16. The reliability estimate using the Kuder-Richardson formula 8 was 0.83.

Control Variables

Two variables were identified as sources of variation on the dependent variables. These variables were intelligence quotient scores and the two factor index of social position.

Intelligence Quotient Scores

Intelligence quotient scores were obtained for the purpose of adjusting for variation in ability level between the treatment groups. It was recognized that intelligence quotient scores obtained from some tests are ratio scores while others refer to deviation scores. In addition to the different I.Q. instruments used by the various school systems, it was recognized that intelligence quotient scores were not obtained in a uniform manner and time. However, due to the large number of schools participating in the study and the variety of standardized tests...
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Items on Test</td>
<td>60.0</td>
</tr>
<tr>
<td>Number of Students in Sample</td>
<td>150.0</td>
</tr>
<tr>
<td>Median</td>
<td>204.0</td>
</tr>
<tr>
<td>Mode</td>
<td>202.0</td>
</tr>
<tr>
<td>Mean</td>
<td>206.45</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>19.16</td>
</tr>
<tr>
<td>Range</td>
<td>128.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>261.0</td>
</tr>
<tr>
<td>Minimum</td>
<td>134.0</td>
</tr>
<tr>
<td>Kuder-Richardson Formula 8</td>
<td></td>
</tr>
<tr>
<td>Reliability Estimate</td>
<td>0.83</td>
</tr>
</tbody>
</table>
used for determining intelligence quotient, an assumption was made that there was no variation between groups due to variation in the intelligence quotient tests used and variation due to test administration.

**Two Factor Index of Social Position**

Scores for determining social position were obtained for the purpose of adjusting for variation in socio-economic status of students between treatment groups. For this purpose, the Two Factor Index of Social Position developed by Hollingshead (1957) was utilized. In explanation of the scale, Hollingshead stated:

The Two Factor Index of Social Position was developed to meet the need for an objective, easily applicable procedure to estimate the positions individuals occupy in the status structure of our society. Its development was dependent both upon detailed knowledge of the social structure, (sic) and procedures social scientists have used to delineate class position. It is premised upon three assumptions: 1) the existence of a status structure in the society; 2) positions in this structure are determined mainly by a few commonly accepted symbolic characteristics; and 3) the characteristics symbolic of status may be scaled and combined by the use of statistical procedures so that a researcher can quickly, reliably, and meaningfully stratify the population under study (p. 2).

To obtain each student's index of social position, information pertaining to his father's occupation and educational level was collected and translated into graduated scales as illustrated:
The Occupational Scale

1. Higher executives of large concerns, proprietors, and major professionals.
3. Administrative personnel, owners of small business, and minor professionals.
4. Clerical and sales workers, technicians, and owners of little businesses.
5. Skilled manual employees.
7. Unskilled employees.

The Educational Scale

2. Four-year college graduate (A.B., B.S., B.M.).
3. 1-3 years college (also business schools).
4. High school graduate.
5. 10-11 years of school (part high school).
6. 7-9 years of school.
7. Less than 7 years of school. (pp. 3-9)

The scores of "Occupational" and "Education" were weighted and combined for each student. For example, if the father of student A was a semi-skilled machine operator and completed his high school education, the computation of the student's Two
Factor Index of Social Position based on this information was computed as follows:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Scale Score</th>
<th>Factor Weight</th>
<th>Score X Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupation</td>
<td>6</td>
<td>7</td>
<td>42</td>
</tr>
<tr>
<td>Education</td>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>

Two Factor Index of Social Position 58

The computational procedures as described were established by Hollingshead (1957).

Formulation of Hypotheses

The purpose of this section is to set forth the formulation of hypotheses for this evaluation study.

The Major Problem

The major problem of this investigation was to compare the cognitive achievement and affective behavior of 1) students enrolled in the two year program developed by the IACP in five field evaluation centers, 2) students enrolled in the IACP program in five field demonstration centers, and 3) students enrolled in conventional junior high school industrial arts programs in which the IACP instructional system was not utilized. Eight questions were posed for this task:

1. Is there a difference by levels in the mean scores on The World of Construction Achievement test—Comprehensive Exam (T1) of students enrolled in the IACP program in the field evaluation centers (X1L1 and X1L2) as com-
pared with students enrolled in the IACP program in the field demonstration centers ($X_2 L_1$ and $X_2 L_2$) and students enrolled in conventional industrial arts courses ($X_3 L_1$ and $X_3 L_2$)?

The following matrix is a conceptual representation of this question.

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_1$</td>
<td>$T_1$</td>
<td>$T_1$</td>
<td>$T_1$</td>
</tr>
<tr>
<td>$L_2$</td>
<td>$T_1$</td>
<td>$T_1$</td>
<td>$T_1$</td>
</tr>
</tbody>
</table>

Hypothesis 1 was derived from this question and was stated in the null form as:

There is no significant difference in the mean achievement level of students enrolled in the first and second year courses of the IACP program in the field evaluation centers, students enrolled in first and second year courses of the IACP program in the field demonstration centers, and students enrolled in first and second year courses of conventional industrial arts programs on The World of Construction Achievement Test-Comprehensive Exam.

2. What difference, if any, in the performance on The World of Construction Achievement Test-Comprehensive Exam exists between pairs of cells in the foregoing matrix?

Hypotheses 2 through 16 were derived from this question and
and are conceptually stated in the null form below:

\[ \begin{align*}
2. & \quad \bar{X}_T(X_1L_1) = \bar{X}_T(X_1L_2) \\
3. & \quad \bar{X}_T(X_1L_1) = \bar{X}_T(X_2L_1) \\
4. & \quad \bar{X}_T(X_1L_1) = \bar{X}_T(X_2L_2) \\
5. & \quad \bar{X}_T(X_1L_1) = \bar{X}_T(X_3L_1) \\
6. & \quad \bar{X}_T(X_1L_1) = \bar{X}_T(X_3L_2) \\
7. & \quad \bar{X}_T(X_2L_1) = \bar{X}_T(X_2L_2) \\
8. & \quad \bar{X}_T(X_2L_1) = \bar{X}_T(X_3L_1) \\
9. & \quad \bar{X}_T(X_2L_1) = \bar{X}_T(X_3L_2) \\
10. & \quad \bar{X}_T(X_2L_1) = \bar{X}_T(X_3L_2) \\
11. & \quad \bar{X}_T(X_3L_1) = \bar{X}_T(X_3L_2) \\
12. & \quad \bar{X}_T(X_3L_1) = \bar{X}_T(X_1L_2) \\
13. & \quad \bar{X}_T(X_3L_1) = \bar{X}_T(X_2L_2) \\
14. & \quad \bar{X}_T(X_2L_2) = \bar{X}_T(X_1L_2) \\
15. & \quad \bar{X}_T(X_2L_2) = \bar{X}_T(X_3L_2) \\
16. & \quad \bar{X}_T(X_1L_2) = \bar{X}_T(X_3L_2)
\end{align*} \]

3. Is there a difference by levels in the performance on The World of Manufacturing Achievement Test-Comprehensive Exam (\(T_2\)) of students enrolled in the IACP program in the field evaluation centers (\(X_1L_1\) and \(X_1L_2\)) as compared with students enrolled in the IACP program in the field demonstration centers (\(X_2L_1\) and \(X_2L_2\)) and students enrolled in conventional industrial arts courses (\(X_3L_1\) and \(X_3L_2\))?

The following matrix is a conceptual representation of this question.
Hypothesis 17 was derived from this question and was stated in the null form as:

There is no significant difference in the mean achievement level of students enrolled in the first and second year courses of the IACP program in the field evaluation centers, students enrolled in first and second year courses of the IACP program in the field demonstration centers, and students enrolled in first and second year courses of conventional industrial arts programs on The World of Manufacturing Achievement Test-Comprehensive Exam.

4. What difference, if any, in the performance on The World of Manufacturing Achievement Test-Comprehensive Exam exists between pairs of cells in the foregoing matrix?

Hypotheses 18 through 32 were derived from this question and are conceptually stated in the null form below:

18 \( \bar{x}T_2(x_{1L_1}) = \bar{x}T_2(x_{1L_2}) \)
19 \( \bar{x}T_2(x_{1L_1}) = \bar{x}T_2(x_{2L_1}) \)
20 \( \bar{x}T_2(x_{1L_1}) = \bar{x}T_2(x_{2L_2}) \)
21 \( \bar{x}T_2(x_{1L_1}) = \bar{x}T_2(x_{3L_1}) \)
22 \( \bar{x}T_2(x_{1L_1}) = \bar{x}T_2(x_{3L_2}) \)
23 \( \bar{x}T_2(x_{2L_1}) = \bar{x}T_2(x_{2L_2}) \)
24 \( \bar{x}T_2(x_{2L_1}) = \bar{x}T_2(x_{3L_1}) \)
5. Is there a difference by levels in the performance on the Cooperative General Industrial Arts Test ($T_3$) of students enrolled in the IACP program in the field evaluation centers ($X_{1L1}$ and $X_{1L2}$) as compared with students enrolled in the IACP program in the field demonstration centers ($X_{2L1}$ and $X_{2L2}$) and students enrolled in conventional industrial arts courses ($X_{3L1}$ and $X_{3L2}$)?

The following matrix is a conceptual representation of this question.

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_1  $</td>
<td>$T_3$</td>
<td>$T_3$</td>
<td>$T_3$</td>
</tr>
<tr>
<td>$L_2  $</td>
<td>$T_3$</td>
<td>$T_3$</td>
<td>$T_3$</td>
</tr>
</tbody>
</table>

Hypothesis 33 was derived from this question and was stated in the null form as:
There is no significant difference in the mean achievement level of students enrolled in the first and second year courses of the IACP program in the field evaluation centers, students enrolled in first and second year courses of the IACP program in the field demonstration centers, and students enrolled in first and second year courses of conventional industrial arts programs on the Cooperative General Industrial Arts Test.

6. What difference, if any, in the performance on the Cooperative General Industrial Arts Test exists between pairs of cells in the foregoing matrix?

Hypotheses 34 through 48 were derived from this question and are conceptually stated in the null form below:

34 \( \bar{X}_T^3(x_{1L1}) = \bar{X}_T^3(x_{1L2}) \)
35 \( \bar{X}_T^3(x_{1L1}) = \bar{X}_T^3(x_{2L1}) \)
36 \( \bar{X}_T^3(x_{1L1}) = \bar{X}_T^3(x_{2L2}) \)
37 \( \bar{X}_T^3(x_{1L1}) = \bar{X}_T^3(x_{3L1}) \)
38 \( \bar{X}_T^3(x_{1L1}) = \bar{X}_T^3(x_{3L2}) \)
39 \( \bar{X}_T^3(x_{2L1}) = \bar{X}_T^3(x_{2L2}) \)
40 \( \bar{X}_T^3(x_{2L1}) = \bar{X}_T^3(x_{3L1}) \)
41 \( \bar{X}_T^3(x_{2L1}) = \bar{X}_T^3(x_{3L2}) \)
42 \( \bar{X}_T^3(x_{2L1}) = \bar{X}_T^3(x_{1L2}) \)
43 \( \bar{X}_T^3(x_{3L1}) = \bar{X}_T^3(x_{3L2}) \)
44 \( \bar{X}_T^3(x_{3L1}) = \bar{X}_T^3(x_{1L2}) \)
45 \( \bar{X}_T^3(x_{3L1}) = \bar{X}_T^3(x_{2L2}) \)
46 \( \bar{X}_T^3(x_{2L2}) = \bar{X}_T^3(x_{1L2}) \)
47 \( \bar{X}T_3(X_2L_2) = \bar{X}T_3(X_3L_2) \)

48 \( \bar{X}T_3(X_1L_2) = \bar{X}T_3(X_3L_2) \)

7. Is there a difference by levels in the performance on the General Scale of Attitudes of Junior High School Industrial Arts (\(T_4\)) of students enrolled in the IACP program in the field evaluation centers (\(X_1L_1\) and \(X_1L_2\)) as compared with students enrolled in the IACP program in the field demonstration centers (\(X_2L_1\) and \(X_2L_2\)) and students enrolled in conventional industrial arts courses (\(X_3L_1\) and \(X_3L_2\))?

The following matrix is a conceptual representation of this question.

\[
\begin{array}{ccc}
X_1 & X_2 & X_3 \\
L_1 & T_4 & T_4 & T_4 \\
L_2 & T_4 & T_4 & T_4 \\
\end{array}
\]

Hypothesis 49 was derived from this question and was stated in the null form as:

There is no significant difference in the mean achievement level of students enrolled in the first and second year courses of the IACP program in the field evaluation centers, students enrolled in first and second year courses of the IACP program in the field demonstration centers, and students enrolled in first and second year courses of conventional industrial arts programs on the General Scale of Attitudes of Junior High School Industrial Arts.
8. What difference, if any, in the performance on the General Scale of Attitudes of Junior High School Industrial Arts exists between pairs of cells in the foregoing matrix?

Hypotheses 50 through 64 were derived from this question and are conceptually stated in the null form below:

\[
\begin{align*}
50 & \quad \overline{X T_4}(X_1L_1) = \overline{X T_4}(X_1L_2) \\
51 & \quad \overline{X T_4}(X_1L_1) = \overline{X T_4}(X_2L_1) \\
52 & \quad \overline{X T_4}(X_1L_1) = \overline{X T_4}(X_2L_2) \\
53 & \quad \overline{X T_4}(X_1L_1) = \overline{X T_4}(X_3L_1) \\
54 & \quad \overline{X T_4}(X_1L_1) = \overline{X T_4}(X_3L_2) \\
55 & \quad \overline{X T_4}(X_2L_1) = \overline{X T_4}(X_2L_2) \\
56 & \quad \overline{X T_4}(X_2L_1) = \overline{X T_4}(X_3L_1) \\
57 & \quad \overline{X T_4}(X_2L_1) = \overline{X T_4}(X_3L_2) \\
58 & \quad \overline{X T_4}(X_2L_1) = \overline{X T_4}(X_1L_2) \\
59 & \quad \overline{X T_4}(X_3L_1) = \overline{X T_4}(X_3L_2) \\
60 & \quad \overline{X T_4}(X_3L_1) = \overline{X T_4}(X_1L_2) \\
61 & \quad \overline{X T_4}(X_3L_1) = \overline{X T_4}(X_2L_2) \\
62 & \quad \overline{X T_4}(X_2L_2) = \overline{X T_4}(X_1L_2) \\
63 & \quad \overline{X T_4}(X_2L_2) = \overline{X T_4}(X_3L_2) \\
64 & \quad \overline{X T_4}(X_1L_2) = \overline{X T_4}(X_3L_2)
\end{align*}
\]

**Sub-Problem One**

In addition to the major problem of this study, two sub-problems were investigated. One of these was to determine if there was a relationship between achievement as compared with intelligence quotient, social position, and geographical location.
of students enrolled in the two year program developed by the IACP as institutionalized in five field evaluation centers. Four question were posed for this task:

1. Is there a difference in the performance on The World of Construction Achievement Test-Comprehensive Exam (T₁) of students enrolled in "The World of Construction" stratified by geographic location (Rₓ)?

The following matrix is a conceptual representation of this question.

<table>
<thead>
<tr>
<th></th>
<th>R₁</th>
<th>R₂</th>
<th>R₃</th>
<th>R₄</th>
<th>R₅</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis 65 was derived from this question and is stated in the null form as:

There is no significant difference in the mean achievement level on The World of Construction Achievement Test-Comprehensive Exam of students enrolled in the first year course of the IACP program in the field evaluation centers: Austin, Texas (R₁); Chicago-Evanston, Illinois (R₂); Cincinnati, Ohio (R₃); Long Beach, California (R₄); and Trenton-Hamilton Township-New Brunswick, New Jersey (R₅).

2. Is there a difference in the performance on The World of Manufacturing Achievement Test-Comprehensive Exam (T₂) enrolled in "The World of Manufacturing" when stratified by geographic location (Rₓ)?
The conceptual representation of this question is:

\[
\begin{array}{ccccc}
R_1 & R_2 & R_3 & R_4 & R_5 \\
T_2 & T_2 & T_2 & T_2 & T_2
\end{array}
\]

Hypothesis 66 was derived from this question and was stated in the null form as:

There is no significant difference in the mean achievement level on The World of Manufacturing Achievement Test, Comprehensive Exam of students enrolled in the second year course of the IACP program in the field evaluation centers: Austin, Texas (R_1); Chicago-Evanston, Illinois (R_2); Cincinnati, Ohio (R_3); Long Beach, California (R_4); and Trenton-Hamilton Township-New Brunswick, New Jersey (R_5).

3. Is there a significant relationship between the performance on The World of Construction Test-Comprehensive Exam, intelligence quotient, and social position of students enrolled in "The World of Construction"?

Hypothesis 67 was derived from this question and was stated in the null form as:

The variables of intelligence quotient and social position are not significant predictors of performance on The World of Construction Test-Comprehensive Exam by students enrolled in "The World of Construction" in the field evaluation centers.

4. Is there a significant relationship between the performance on The World of Manufacturing
Test-Comprehensive Exam, intelligence quotient, and social position of students enrolled in "The World of Manufacturing"?

Hypothesis 68 was derived from this question and was stated in the null form as:

The variables of intelligence quotient and social position are not significant predictors of performance in The World of Manufacturing Test-Comprehensive Exam by students enrolled in "The World of Construction" in the field evaluation centers.

Sub-Problem Two

The second sub-problem of this evaluation study was to compare the achievement of students enrolled in "The World of Construction" course with students enrolled in "The World of Manufacturing" concerning the total body of knowledge of industry as established in "The Rationale and Structure of Industrial Arts Subject Matter" (Towers, Lux, and Ray, 1966). The question posed for this task was:

Is there a difference in the collective performance on The World of Construction Achievement Test-Comprehensive Exam and The World of Manufacturing Achievement Test-Comprehensive Exam of students enrolled in "The World of Construction" as compared with the collective performance on The World of Construction Achievement Test-Comprehensive Exam and The World of Manufacturing Achievement Test-
Comprehensive Exam of students enrolled in "The World of Manufacturing"?

The conceptual representation of this question is:

Does $\bar{X}_T(X_{1L1}) + T_2(X_{1L1}) = \bar{X}_T(X_{1L2}) + T_2(X_{1L2})$?

Hypothesis 69 was derived from this question and was stated in the null form as:

There is no significant difference in the mean achievement level on The World of Construction Achievement Test - Comprehensive Exam and The World of Manufacturing Achievement Test - Comprehensive Exam of students enrolled in "The World of Construction" as compared with the mean achievement level on The World of Construction Achievement Test - Comprehensive Exam and The World of Manufacturing Achievement Test - Comprehensive Exam of students enrolled in "The World of Manufacturing."

Procedure for Sampling

The purpose of this section is to explain the target populations, the data collection procedures, and procedures for managing the study.

Populations

Three populations were utilized from which the samples were drawn. These were:

1. The students enrolled in "The World of Construction" and "The World of Manufacturing" in the six field evaluation centers of the IACP.
2. The students enrolled in "The World of Construction" and "The World of Manufacturing" in the demonstration centers of the IACP.

3. The students enrolled in first year and second year junior high school conventional industrial arts programs located in and around the field evaluation centers.

Several delimitations were established after these populations were originally identified. These delimitations were:

1. Centers not offering both "The World of Construction" and "The World of Manufacturing" were excluded from the field evaluation center and field demonstration center populations.

2. Schools meeting criteria one from the demonstration center in Newark, New Jersey were excluded because the schools had been closed for a substantial part of the 1970-71 academic year due to contractual difficulties with the teaching staff.

3. Two schools from the Cincinnati (Ohio) field evaluation center were excluded because another research project was being conducted in these schools.
4. Two schools were chosen from school systems in each of the field evaluation centers to represent the conventional industrial arts population. These schools were selected by the field evaluation center directors. Five criteria were used to select these schools. These were:

a. each school must offer a two year conventional industrial arts program (including required and/or elective courses) at the same grade level as the IACP construction and manufacturing courses.

b. each school should have at least 3 classes of students enrolled in a first year program at the same grade level as the IACP construction course.

c. each school should have at least 3 classes of students enrolled in a second year industrial arts program at the same grade level as the IACP manufacturing course.

d. the schools should be of comparable socioeconomic status to the schools offering the IACP program in the field evaluation center.
e. each school should have teachers that
are willing to cooperate and will be a
professional asset to the study.

Further delimitations were made as the study progressed.

These delimitations were:

1. The Dade County, Florida field evaluation center
and the Pittsburg, Pennsylvania field demonstration
center were excluded from the study because I.Q.
data could not be released due to administrative
policy.

2. One school in the Trenton-Hamilton Township, New
Brunswick, New Jersey field evaluation center and
two schools in the Chicago-Evanston, Illinois
field evaluation center were excluded from the
study for failure to furnish the requested data.

With the above stated delimitations placed on the pop­
ulations, a target population was identified. This population
was described as follows:

1. The students enrolled in "The World of
Construction" and "The World of Manufacturing" in
five field evaluation centers of the IACP during the
1970-71 academic year. These centers were Long Beach,
California; Trenton-Hamilton Township, New Brunswick,
New Jersey; Chicago-Evanston, Illinois; Cincinnati,
Ohio; and Austin, Texas.
2. The students enrolled in "The World of Construction" and "The World of Manufacturing" in the demonstration centers of the IACP during the 1970-71 academic year. The demonstration centers included in the study were Shawnee Mission, Kansas; Pontiac, Michigan; Reno, Nevada; Columbus, Ohio; and Manassas County, Virginia.

3. The students enrolled in ten first year and second year junior high school conventional industrial arts programs located in and around the five field evaluation centers previously described during the 1970-71 academic year.

A summary of the target population is illustrated in Table 6. The target population included 33 schools. An estimate of the number of students in the population was 3,960 based on an estimated class size of 20. Exact student figures were not possible due to the large number of variables of establishing what constitutes a class member, accuracy in reporting the data, and accuracy in recording the data. The total number of students and classes that were tested and for which the answer sheets were returned to the researcher were 3,128 and 165 respectfully. Table 7 illustrates how the students were divided among the target populations of the study.

A complete list of teachers that participated in this evaluation study is contained in Appendix E (Sampling Frame) of this research report.
### Table 6

**Target Population**

<table>
<thead>
<tr>
<th></th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Schools</strong></td>
<td>15</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td><strong>Course</strong></td>
<td>Construction</td>
<td>Manufacturing</td>
<td>Construction</td>
</tr>
<tr>
<td>Classes/Course/School</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Students/Course/School</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Students/Center <em>a</em></td>
<td>900</td>
<td>900</td>
<td>480</td>
</tr>
</tbody>
</table>

Number of schools in the sample population = 33. Estimate of students in the population = 3960.

*Figures are based on a class size estimate of 20 students.*
### Table 7

**DISTRIBUTION OF STUDENTS IN THE POPULATIONS THAT WERE TESTED**

<table>
<thead>
<tr>
<th></th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Students per program</strong></td>
<td>1715</td>
<td>611</td>
<td>802</td>
</tr>
<tr>
<td><strong>Experimental treatment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Classes per treatment</strong></td>
<td>45</td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td><strong>Students per treatment</strong></td>
<td>910</td>
<td>333</td>
<td>457</td>
</tr>
<tr>
<td></td>
<td>805</td>
<td>278</td>
<td>345</td>
</tr>
<tr>
<td><strong>Students that completed test T1</strong></td>
<td>229</td>
<td>88</td>
<td>106</td>
</tr>
<tr>
<td></td>
<td>199</td>
<td>72</td>
<td>87</td>
</tr>
<tr>
<td><strong>Students that completed test T2</strong></td>
<td>223</td>
<td>86</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>202</td>
<td>69</td>
<td>88</td>
</tr>
<tr>
<td><strong>Students that completed test T3</strong></td>
<td>229</td>
<td>84</td>
<td>114</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>71</td>
<td>89</td>
</tr>
<tr>
<td><strong>Students that completed test T4</strong></td>
<td>229</td>
<td>75</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>204</td>
<td>66</td>
<td>81</td>
</tr>
</tbody>
</table>

Number of students that participated in the study = 3128
Number of classes that participated in the study = 165
Data Collection Procedure

Preparing test materials, administering the tests, and returning the test results to The Ohio State University was the central focus of the data collection procedure. To insure that these tasks were completed with a minimum amount of difficulty, aid was requested from the field evaluation center directors and field demonstration directors and superivsors. In response to this request, the researcher was successful in finding a person that was willing to coordinate the activities of the involved teachers and students in each center and to see that the appropriate data was collected and returned to the researcher. A complete list of these men is contained in Appendix E of this research report.

The needed materials for this study were sent to the field centers in two installments. The first installment, mailed to the centers in mid-April, 1971, contained a series of four page questionnaires entitled "Class Data Sheets". The purpose of these forms was to collect normative data about the classes that participated in the study. A copy of the "Class Data Sheets" is located in Appendix F. The second installment was sent in mid-May, 1971 and included a package of test materials for each participating teacher. The packages contained a set of 32 test instruments which contained eight of each of the four different kinds of instruments used in the study. Also contained in these packages was a set of machine scoreable answer sheets for each class and the directions for administering the tests.
The students in each class were randomly assigned to one of the four tests. The four different test instruments were then administered at the same time in each class. This procedure allowed for approximately twenty-five per cent of the class to complete each test. A time limit of 35 minutes was established in which the students were allowed to complete the tests. Following administration of the tests, the test materials were returned to the researcher for scoring and analysis.

Data Handling Procedure

After the student answer sheets were returned to the IACP headquarters, they were categorized according to the test, field center, and variable of central concern. This was followed by drawing the samples needed to test the hypotheses as detailed earlier in this chapter.

Four stratified (by variable of central concern) random samples of 150 answer sheets each were obtained to answer hypotheses through as illustrated in the following matrices:

**Test instrument-T$$\text{i}$$**

<table>
<thead>
<tr>
<th></th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>L2</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>
Test Instrument-T_2
Hypotheses 17 through 32

\[
\begin{array}{ccc}
X_1 & X_2 & X_3 \\
L_1 & 25 & 25 & 25 \\
L_2 & 25 & 25 & 25 \\
\end{array}
\]

Test Instrument-T_3
Hypotheses 33 through 48

\[
\begin{array}{ccc}
X_1 & X_2 & X_3 \\
L_1 & 25 & 25 & 25 \\
L_2 & 25 & 25 & 25 \\
\end{array}
\]

Test Instrument-T_4
Hypotheses 49 through 64

\[
\begin{array}{ccc}
X_1 & X_2 & X_3 \\
L_1 & 25 & 25 & 25 \\
L_2 & 25 & 25 & 25 \\
\end{array}
\]

The matrices below represent the two stratified samples of 75 each that were used to test hypotheses 65 and 66:

Test Instrument-T_1
Hypothesis 65
Test Instrument-T₂
Hypothesis 66

Hypotheses 67 and 68 were each tested, randomly selecting two samples of 50 answer sheets each of students completing T₁ enrolled in "The World of Construction" and of students completing T₂ enrolled in "The World of Manufacturing."

A stratified random sample of 100 was selected to answer hypothesis 69 as illustrated in the matrix:

Analysis of the Data

Data analysis procedures of this evaluation study are the central focus of this section.

Following the selection of samples for the study, the answer
sheets for the four test instrument were optically scanned and scored. Next the data were subjected to an item analysis program. This program produced a series of summary statistics which included the mean, median, mode, standard deviation, skewness, kurtosis, and Kuder-Richardson reliability estimate.

Computer data cards were key punched to contain the scores for the test instruments and control variables for each student. These cards served as the data decks for the computer programs used to test the hypotheses of the study. Statistical techniques used for these tests included analysis of covariance, Duncan's new multiple range test and stepwise multiple regression analysis.

Chapter Summary

The purpose of this chapter was to set forth the methods and procedures used in this evaluation study. The first section introduced the variables and detailed the research design of the study. The variables of central concern were set forth in the second section. This was followed with an explanation of the four test instruments and two control variables. Research questions were formulated and hypotheses were structured. A discussion of the procedures for sampling and data collection were also presented. The last section of the chapter contained a brief description of the procedures used for the analysis of data in the study.

Chapter IV will contain an analysis of the data obtained in this study.
CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

The purpose of this chapter is to set forth the data obtained from the study and analyze them in relation to each of the research hypotheses.

Answers to the questions on the four test instrument were recorded on optical scanning sheets. From these sheets, computer data cards were punched by the Center of Measurement and Evaluation at The Ohio State University. Following this procedure, computer programs were completed that provided the test score for each subject.

Sampling procedures were next employed as described in Chapter III. For each subject in the samples drawn, an identification number, the variable score, and his two control variables (intelligence quotient and social position) were placed on a computer data card. After this process was completed, the hypotheses for this evaluation study were tested statistically with technical assistance provided by the Statistics Laboratory of The Ohio State University.

The major problem of this investigation was to compare the cognitive achievement and affective behavior of 1) students enrolled in the two year program developed by the IACP in five
field evaluation centers, 2) students enrolled in the IACP program in five field demonstration centers, and 3) students enrolled in conventional junior high school industrial arts programs in which the IACP instructional system was not utilized. Sixty four hypotheses were posed for this task.

The World of Construction Achievement Test-Comprehensive Exam

Hypotheses 1 through 16 dealt with scores of subjects that completed The World of Construction Achievement Test-Comprehensive Exam (T$_1$). To test these hypotheses, a sample of 150 scores were drawn equally divided from the six variables of central concern. Table 8 contains the summary statistics of The World of Construction Achievement Test-Comprehensive Exam for these samples. From the data as described in Table 8, it seemed apparent that the students, when stratified by groups, differed in their performance on T$_1$. The mean scores for the groups varied from 32.40 for "Construction" students in the field demonstration centers to 20.28 for the "Industrial Arts II" students. In addition, the K-R 20 reliability estimates and mean item discrimination of the conventional program students varied markedly from IACP students.

The means and standard deviations for the sample groups that completed T$_1$ are contained in Table 9. The total sample had a mean intelligence quotient of 103.25 and a mean social position score of 45.13.
TABLE 8
SUMMARY STATISTICS OF THE SAMPLE THAT COMPLETED THE WORLD OF CONSTRUCTION ACHIEVEMENT TEST, COMPREHENSIVE EXAM

<table>
<thead>
<tr>
<th></th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Construction</td>
<td>Manufacturing</td>
<td></td>
</tr>
<tr>
<td>Number of Students</td>
<td>25.0</td>
<td>25.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Median</td>
<td>29.0</td>
<td>26.0</td>
<td>23.0</td>
</tr>
<tr>
<td>Mean (unadjusted)</td>
<td>26.00</td>
<td>27.36</td>
<td>21.84</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>10.70</td>
<td>11.33</td>
<td>7.04</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.14</td>
<td>0.06</td>
<td>-0.01</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.99</td>
<td>-1.20</td>
<td>-0.76</td>
</tr>
<tr>
<td>Range</td>
<td>41.0</td>
<td>36.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>46.0</td>
<td>46.0</td>
<td>36.0</td>
</tr>
<tr>
<td>Minimum</td>
<td>5.0</td>
<td>10.0</td>
<td>11.0</td>
</tr>
<tr>
<td>K-R 20 Reliability Estimate</td>
<td>0.92</td>
<td>0.93</td>
<td>0.80</td>
</tr>
<tr>
<td>Mean Item Difficulty</td>
<td>0.47</td>
<td>0.45</td>
<td>0.49</td>
</tr>
<tr>
<td>Mean Item Discrimination</td>
<td>0.53</td>
<td>0.57</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Industrial Arts I
Industrial Arts II
TABLE 9
SUMMARY STATISTICS OF THE CONCOMITANT VARIABLES FOR THE SAMPLE OF STUDENTS THAT COMPLETED THE WORLD OF CONSTRUCTION ACHIEVEMENT TEST, COMPREHENSIVE EXAM

<table>
<thead>
<tr>
<th></th>
<th>Total Sample</th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Construction</td>
<td>Manufacturing</td>
<td>Construction</td>
</tr>
<tr>
<td>Intelligence Quotient Mean</td>
<td>103.25</td>
<td>100.44</td>
<td>100.96</td>
<td>108.72</td>
</tr>
<tr>
<td>Intelligence Quotient SD</td>
<td>14.77</td>
<td>14.49</td>
<td>17.82</td>
<td>11.46</td>
</tr>
<tr>
<td>Social Position Mean</td>
<td>45.13</td>
<td>47.35</td>
<td>48.72</td>
<td>38.28</td>
</tr>
<tr>
<td>Social Position SD</td>
<td>16.88</td>
<td>15.37</td>
<td>15.58</td>
<td>20.57</td>
</tr>
</tbody>
</table>
Hypothesis 1

Using the data cards of the six samples of students that completed T1, hypothesis 1 was tested by using the F-ratio test of a two way analysis of covariance adjusted for two control variables. The following matrix is a conceptual representation of the samples tested:

```
  X1  X2  X3
L1  xT1 xT1 xT1
L2  xT1 xT1 xT1
```

An explanation of the symbolic language of this conceptual representation follows:

- $\bar{X}T_1$ = The mean of a sample of 25 completing The World of Construction Achievement Test-Comprehensive Exam
- $X_1$ = IACP-field evaluation centers
- $X_2$ = IACP-field demonstration centers
- $X_3$ = conventional industrial arts programs
- A = Direction of variance "A"
- B = Direction of variance "B"

The data cards were processed through the BMD X69 program at The Ohio State University Data Processing Center. Results of the BMD X69 program are contained in Table 10, a summary table of the two way analysis of covariance. The table shows that T1
TABLE 10
TWO-WAY ANALYSIS OF COVARIANCE OF THE WORLD OF CONSTRUCTION
ACHIEVEMENT TEST-COMPREHENSIVE EXAM ADJUSTED
FOR TWO CONTROL VARIABLES

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DEGREES OF FREEDOM</th>
<th>MEAN SQUARE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-By Levels</td>
<td>46.0195</td>
<td>1</td>
<td>46.0195</td>
<td>0.74</td>
</tr>
<tr>
<td>B-Across Programs</td>
<td>904.6641</td>
<td>2</td>
<td>452.3320</td>
<td>7.31</td>
</tr>
<tr>
<td>AB-Interaction</td>
<td>321.8477</td>
<td>2</td>
<td>160.9238</td>
<td>2.60</td>
</tr>
<tr>
<td>Covariates</td>
<td>5750.6172</td>
<td>2</td>
<td>2875.3086</td>
<td>46.49</td>
</tr>
<tr>
<td>Covariate 1b</td>
<td>4902.8672</td>
<td>1</td>
<td>4902.8672</td>
<td>79.27</td>
</tr>
<tr>
<td>Covariate 2c</td>
<td>1.5191</td>
<td>1</td>
<td>1.5191</td>
<td>0.02</td>
</tr>
<tr>
<td>S(AB)-Within Cells</td>
<td>8782.9727</td>
<td>142</td>
<td>61.8519</td>
<td></td>
</tr>
</tbody>
</table>

*a Significant at the .05 level
*b Covariate 1--Intelligence Quotient
*c Covariate 2--Social Position
was dependent on the combined covariates with an F-ratio of 46.49 which was significant at the .05 level of confidence. Analysis of the covariates separately revealed a significant F-ratio for covariate 1 (intelligence quotient) while covariate 2 (social position) was shown not to be significant.

Hypothesis 1:

There is no significant difference in the mean achievement level of students enrolled in the first and second year courses of the IACP program in the field evaluation centers, students enrolled in first and second year courses of the IACP program in the field demonstration centers, and students enrolled in first and second year courses of conventional industrial arts programs on The World of Construction Achievement Test-Comprehensive Exam.

The hypothesis was rejected as the F-ratio of 7.31 for source B (across programs) was found to be significant at the .05 level of confidence. Interaction effect and source A (by levels) were not significant.

Analysis: Based on the F-ratio as shown in Table 10, a significant difference did exist among the six variables of central concern pertaining to the scores on The World of Construction Achievement Test-Comprehensive Exam.

Hypotheses 2 through 16

To locate where the differences existed between the six variables of central concern, Duncan's new multiple range test was used to test hypotheses 2 through 16. Table 11 contains a summary of this statistical test for the six groups. The adjusted
TABLE II
ANALYSIS OF THE DIFFERENCE BETWEEN THE ADJUSTED MEANS ON THE WORLD OF CONSTRUCTION ACHIEVEMENT TEST-COMPREHENSIVE EXAM OF THE SIX VARIABLES OF CENTRAL CONCERN

<table>
<thead>
<tr>
<th>Adjusted Means</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_3L_1$</td>
<td>21.968</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$X_3L_2$</td>
<td>22.708</td>
<td>0.740</td>
<td>2.728</td>
<td>5.272$^a$</td>
<td>6.414$^a$</td>
<td>7.995$^a$</td>
</tr>
<tr>
<td>$X_2L_2$</td>
<td>24.696</td>
<td>1.988</td>
<td>4.533$^a$</td>
<td>5.675$^a$</td>
<td>7.255$^a$</td>
<td></td>
</tr>
<tr>
<td>$X_1L_1$</td>
<td>27.241</td>
<td>2.544</td>
<td>3.686</td>
<td>5.267$^a$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$X_1L_2$</td>
<td>28.383</td>
<td></td>
<td></td>
<td>1.142</td>
<td>2.723</td>
<td></td>
</tr>
<tr>
<td>$X_2L_1$</td>
<td>29.964</td>
<td></td>
<td></td>
<td></td>
<td>1.581</td>
<td></td>
</tr>
</tbody>
</table>

$R_1=3.680$  $R_2=3.892$  $R_3=4.032$  $R_4=4.132$  $R_5=4.211$

$^a$Significant at the .05 level
mean scores are placed in ascending order in the headings at the top of the table and down the left hand column. Columns numbered 2 through 6 show the differences between each pair of adjusted means. At the bottom of the table, the shortest significant ranges ($R_X$) are reported as derived by procedures set forth by Edwards (1968, pp. 131-5). The difference between two adjusted means is significant if it exceeds the corresponding shortest significant range.

Seven of the paired adjusted means were found to be significantly different.

Hypothesis 5:

$$\bar{X}_{T1}(X_{L1}) = \bar{X}_{T1}(X_{L3})$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_4$.

Analysis: The mean score on $T_1$ of students enrolled in "Construction" in the field evaluation centers was significantly higher than of students enrolled in Industrial Arts I.

Hypothesis 6:

$$\bar{X}_{T1}(X_{L1}) = \bar{X}_{T1}(X_{L2})$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_4$.

Analysis: The mean score on $T_1$ of students enrolled in "Construction" in the field evaluation centers was signif-
icantly higher than of students enrolled in Industrial Arts II.

Hypothesis 7:

\[ \overline{XT_1}(X_{2L_1}) = \overline{XT_1}(X_{2L_2}) \]

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for \( R_6 \).

Analysis: The mean score on \( T_1 \) of students enrolled in "Construction" in the field demonstration centers was significantly higher than of students enrolled in "Manufacturing" in the field demonstration centers.

Hypothesis 8:

\[ \overline{XT_1}(X_{2L_1}) = \overline{XT_1}(X_{3L_1}) \]

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for \( R_6 \).

Analysis: The mean score on \( T_1 \) of students enrolled in "Construction" in the field demonstration centers was significantly higher than of students enrolled in Industrial Arts I.

Hypothesis 9:

\[ \overline{XT_1}(X_{2L_1}) = \overline{XT_1}(X_{3L_2}) \]

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for \( R_6 \).
Analysis: The mean score on $T_1$ of students enrolled in "Construction" in the field demonstration centers was significantly higher than of students enrolled in Industrial Arts II.

Hypothesis 12:

$$\bar{x}_{T1}(X3L1) = \bar{x}_{T1}(X1L2)$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_5$.

Analysis: The mean score on $T_1$ of students enrolled in "Manufacturing" in the field evaluation centers was significantly higher than of students enrolled in Industrial Arts I.

Hypothesis 16:

$$\bar{x}_{T1}(X1L2) = \bar{x}_{T1}(X3L2)$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_5$.

Analysis: The mean score on $T_1$ of students enrolled in "Manufacturing" in the field evaluation centers was significantly higher than of students enrolled in Industrial Arts II.

In analysis of the paired means for $T_1$, eight hypotheses were not rejected as no significant difference between the adjusted means was found. The accepted null hypotheses were:

2. $\bar{x}_{T1}(X1L1) = \bar{x}_{T1}(X1L2)$ Not rejected
3. $\bar{x}_{T1}(X1L1) = \bar{x}_{T1}(X2L1)$ Not rejected
4. $\bar{x}_{T1}(X1L1) = \bar{x}_{T1}(X2L2)$ Not rejected
10. $\bar{x}_{T1}(X2L1) = \bar{x}_{T1}(X1L2)$ Not rejected
Section Summary

An analysis of the data derived from students who completed The World of Construction Achievement Test-Comprehensive Exam revealed that the six groups of students were different in the level of cognitive achievement displayed. Of particular importance was the fact that "Construction" students in the field evaluation centers and the field demonstration centers performed at a significantly higher level than did students enrolled in conventional industrial arts. An unexpected phenomena, in the analysis, was the significantly lower mean score of "Manufacturing" students as compared with "Construction" students in the field demonstration centers.

The World of Manufacturing Achievement Test-Comprehensive Exam

Hypotheses 17 through 32 focused on scores of students that completed The World of Manufacturing Achievement Test-Comprehensive Exam ($T_2$). A random sample of 25 was drawn from each of six variables of central concern for statistical analysis. Table 12 contains the summary statistics of test scores derived from the six groups in the sample. In examination of the
### TABLE 12
SUMMARY STATISTICS OF THE SAMPLE THAT COMPLETED THE WORLD OF MANUFACTURING ACHIEVEMENT TEST, COMPREHENSIVE EXAM

<table>
<thead>
<tr>
<th></th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Construction</td>
<td>Manufacturing</td>
<td>Construction</td>
</tr>
<tr>
<td>Number of Students</td>
<td>25.0</td>
<td>25.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Median</td>
<td>19.0</td>
<td>25.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Mean (unadjusted)</td>
<td>18.76</td>
<td>24.92</td>
<td>20.36</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>5.82</td>
<td>9.32</td>
<td>5.84</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.15</td>
<td>0.15</td>
<td>-0.04</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-1.03</td>
<td>-0.54</td>
<td>-0.58</td>
</tr>
<tr>
<td>Range</td>
<td>21.0</td>
<td>37.0</td>
<td>24.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>29.0</td>
<td>43.0</td>
<td>33.0</td>
</tr>
<tr>
<td>Minimum</td>
<td>8.0</td>
<td>6.0</td>
<td>9.0</td>
</tr>
<tr>
<td>K-R 20 Reliability Estimate</td>
<td>0.71</td>
<td>0.89</td>
<td>0.71</td>
</tr>
<tr>
<td>Mean Item Difficulty</td>
<td>0.62</td>
<td>0.55</td>
<td>0.59</td>
</tr>
<tr>
<td>Mean Item Discrimination</td>
<td>0.29</td>
<td>0.46</td>
<td>0.28</td>
</tr>
</tbody>
</table>
data described in the table, it appeared that the students enrolled in "Manufacturing" achieved better than the other four groups. The reliability estimates for the groups ranged from a high of 0.92 to a low of 0.60 which might be considered low for an achievement test. The mean item discrimination also appears to be low for the six groups (0.57 to 0.26).

A summary of the control variables for the sample of students that completed The World of Manufacturing is contained in Table 13. There was considerable deviation in the difference between mean intelligence quotient points. However the standard deviations for intelligence quotient scores for the six groups appeared to be similar. The overall mean of the social position variable was 44.15 and did not seem to vary much when comparing the six groups.

**Hypothesis 1**

Hypothesis 1 was tested using the same procedure as described for hypothesis 1. Computer data cards were punched and processed using the BMD X69 program. The following matrix is a conceptual representation of the samples tested.
Table 13

Summary Statistics of the Concomitant Variables for the Sample of Students That Completed the World of Manufacturing Achievement Test, Comprehensive Exam

<table>
<thead>
<tr>
<th>Total Sample</th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Construction</td>
<td>Manufacturing</td>
<td>Construction</td>
</tr>
<tr>
<td>Intelligence Quotient Mean</td>
<td>99.48</td>
<td>98.00</td>
<td>103.36</td>
</tr>
<tr>
<td>Social Position Mean</td>
<td>44.15</td>
<td>45.60</td>
<td>46.60</td>
</tr>
<tr>
<td>Social Position Standard Deviation</td>
<td>16.78</td>
<td>15.15</td>
<td>18.06</td>
</tr>
</tbody>
</table>
\( \bar{X}_{T_2} \) = The mean of a sample of 25 that completed The World of Manufacturing Achievement Test-Comprehensive Exam.

\( X_1 \) = IACP-field evaluation centers
\( X_2 \) = IACP-field demonstration centers
\( X_3 \) = conventional industrial arts programs
\( A \) = Direction of variance "A"
\( B \) = Direction of variance "B"

Results of this computational technique are found in Table 14, which contains the summary table of the two way analysis of covariance for \( T_2 \). The adjustment of \( T_2 \) scores were highly dependent on intelligence quotient with an F-ratio of 44.59. However the other control variable, social position, had little effect on the sample means of \( T_2 \). These findings are similar to the results for the two way analysis of covariance for \( T_1 \) used to test hypothesis 1.

Hypothesis 17:
There is no significant difference in the mean achievement level of students enrolled in the first and second year courses of the IACP program in the field evaluation centers, students enrolled in first and second year courses of the IACP program in the field demonstration centers, and students enrolled in first and second year courses of conventional industrial arts programs on The World of Manufacturing Achievement Test-Comprehensive Exam.

The hypothesis was rejected as the F-ratio of 9.43 for source A (by levels) and the F-ratio of 3.22 for source B (across programs) were both significant at the .05 level of confidence. Interaction effect was not significant.
TABLE 14
TWO-WAY ANALYSIS OF COVARIANCE OF THE WORLD OF MANUFACTURING
ACHIEVEMENT TEST-COMPREHENSIVE EXAM ADJUSTED
FOR TWO CONTROL VARIABLES

(N=150)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DEGREES OF FREEDOM</th>
<th>MEAN SQUARE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-By Levels</td>
<td>422.2578</td>
<td>1</td>
<td>422.2578</td>
<td>9.43</td>
</tr>
<tr>
<td>B-Across Programs</td>
<td>288.2734</td>
<td>2</td>
<td>144.1367</td>
<td>3.22</td>
</tr>
<tr>
<td>AB-Interaction</td>
<td>107.0469</td>
<td>2</td>
<td>53.5234</td>
<td>1.20</td>
</tr>
<tr>
<td>Covariates</td>
<td>2413.6953</td>
<td>2</td>
<td>1206.8477</td>
<td>26.96</td>
</tr>
<tr>
<td>Covariate 1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1995.7778</td>
<td>1</td>
<td>1995.7778</td>
<td>44.59</td>
</tr>
<tr>
<td>Covariate 2&lt;sup&gt;c&lt;/sup&gt;</td>
<td>17.7848</td>
<td>1</td>
<td>17.7848</td>
<td>0.40</td>
</tr>
<tr>
<td>S(AB)-Within Cells</td>
<td>6356.2539</td>
<td>142</td>
<td>44.7623</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant at the .05 level

<sup>b</sup>Covariate 1--Intelligence Quotient

<sup>c</sup>Covariate 2--Social Position
Analysis: The mean scores on $T_2$ of students enrolled in the six courses were significantly different in direction but not in interaction.

Hypotheses 18 through 32

To locate where the differences existed between the six groups, Duncan's new multiple range test was used as described earlier. Table 15 contains a summary of this statistical test for the adjusted means of the six groups.

Eight of the paired adjusted means were found to be significantly different.

Hypothesis 18:

$$\bar{X}_{T_2}(X_1L_1) = \bar{X}_{T_2}(X_1L_2)$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_6$.

Analysis: The mean score on $T_2$ of students enrolled in "Manufacturing" in the field evaluation centers was significantly higher than of students enrolled in "Construction" in the field evaluation centers.

Hypothesis 20:

$$\bar{X}_{T_2}(X_1L_1) = \bar{X}_{T_2}(X_2L_2)$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_5$.

Analysis: The mean score on $T_2$ of students enrolled in
TABLE 15

ANALYSIS OF THE DIFFERENCE BETWEEN THE ADJUSTED MEANS ON THE WORLD OF MANUFACTURING ACHIEVEMENT TEST-COMPREHENSIVE EXAM OF THE SIX VARIABLES OF CENTRAL CONCERN

<table>
<thead>
<tr>
<th>Adjusted Means</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_3L_1$</td>
<td>17.989</td>
<td>18.950</td>
<td>19.224</td>
<td>19.260</td>
<td>23.756</td>
<td>23.903</td>
</tr>
<tr>
<td>$X_3L_2$</td>
<td>0.960</td>
<td>1.235</td>
<td>1.271</td>
<td>5.767$^a$</td>
<td>5.914$^a$</td>
<td></td>
</tr>
<tr>
<td>$X_1L_1$</td>
<td>0.274</td>
<td>0.310</td>
<td>4.806$^a$</td>
<td>4.953$^a$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$X_1L_2$</td>
<td>0.036</td>
<td>4.532$^a$</td>
<td>4.679$^a$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$X_2L_1$</td>
<td>4.496$^a$</td>
<td>4.643$^a$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$X_2L_2$</td>
<td>0.147</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$R_2=3.141$ $R_3=3.322$ $R_4=3.441$ $R_5=3.527$ $R_6=3.594$

$^a$Significant at the .05 level
"Manufacturing" in the field demonstration centers was significantly higher than of students enrolled in "Construction" in the field evaluation centers.

Hypothesis 23:
\[ \bar{X}_{T2}(X_{2L1}) = \bar{X}_{T2}(X_{2L2}) \]

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for \( R_5 \).

Analysis: The mean score on \( T_2 \) of students enrolled in "Manufacturing" in the field demonstration centers was significantly higher than of students enrolled in "Construction" in the field demonstration centers.

Hypothesis 26:
\[ \bar{X}_{T2}(X_{2L1}) = \bar{X}_{T2}(X_{1L2}) \]

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for \( R_6 \).

Analysis: The mean score on \( T_2 \) of students enrolled in "Manufacturing" in the field evaluation centers was significantly higher than of students enrolled in "Construction" in the field demonstration centers.

Hypothesis 28:
\[ \bar{X}_{T2}(X_{3L1}) = \bar{X}_{T2}(X_{1L2}) \]

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for \( R_6 \).
Analysis: The mean score on $T_2$ of students enrolled in "Manufacturing" in the field evaluation centers was significantly higher than of students enrolled in Industrial Arts I.

Hypothesis 29:

$$\overline{XT_2}(X_3L_1) = \overline{XT_2}(X_2L_2)$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_5$.

Analysis: The mean score on $T_2$ of students enrolled in "Manufacturing" in the field demonstration centers was significantly higher than of students enrolled in Industrial Arts I.

Hypothesis 31:

$$\overline{XT_2}(X_2L_2) = \overline{XT_2}(X_3L_2)$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_5$.

Analysis: The mean score on $T_2$ of students enrolled in "Manufacturing" in the field demonstration centers was significantly higher than of students enrolled in Industrial Arts II.

Hypothesis 32:

$$\overline{XT_2}(X_1L_2) = \overline{XT_2}(X_3L_2)$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_6$. 
Analysis: The mean score on $T_2$ of students enrolled in "Manufacturing" in the field evaluation centers was significantly higher than of students enrolled in Industrial Arts II.

The analysis of the paired means for $T_2$ supported the non-rejection of seven hypotheses. These hypotheses were:

19. $\bar{X}T_2(X_{1L1}) = \bar{X}T_2(X_{2L1})$ Not rejected
21. $\bar{X}T_2(X_{1L1}) = \bar{X}T_2(X_{3L1})$ Not rejected
22. $\bar{X}T_2(X_{1L1}) = \bar{X}T_2(X_{3L2})$ Not rejected
24. $\bar{X}T_2(X_{2L1}) = \bar{X}T_2(X_{3L1})$ Not rejected
25. $\bar{X}T_2(X_{2L1}) = \bar{X}T_2(X_{3L2})$ Not rejected
27. $\bar{X}T_2(X_{3L1}) = \bar{X}T_2(X_{3L2})$ Not rejected
30. $\bar{X}T_2(X_{2L2}) = \bar{X}T_2(X_{1L2})$ Not rejected

Section Summary

The analysis of data of the sample of students who completed The World of Manufacturing Achievement Test-Comprehensive Exam revealed that the six groups were different in the level of cognitive achievement. The "Manufacturing" student in the field evaluation centers and the field demonstration centers performed at a significantly higher level than did the "Construction" students and the conventional industrial arts students.

The Cooperative General Industrial Arts Test

Hypotheses 33 through 48 dealt with scores of students
that completed the Cooperative General Industrial Arts Test (T₃). A random sample of 25 was drawn from each of the six variables of central concern for statistical analysis. Table 16 contains the summary statistics of test scores gathered from the six groups in the overall sample. An examination of the table revealed that the mean scores for the six groups ranged from 26.52 for "Manufacturing" students in the field evaluation centers to 20.96 for students enrolled in Industrial Arts II. The standard deviations for the six groups were approximately the same with a range of less than 2 standard deviation points. Variance of the reliability estimates and measures for the mean item difficulty and item discrimination also appeared to be minimal.

A summary of the control variables for the sample of students that completed the Cooperative General Industrial Arts Test is contained in Table 17. The total sample had a mean intelligence quotient of 100.89 and a mean social position score of 45.17. Standard deviations for both control variables differed markedly between groups.

Hypothesis 33

Hypothesis 33 was tested using the same procedure as for hypotheses 1 and 17. Computer cards were punched and processed using the BMD X69 program. The following matrix is a conceptual representation of the samples tested.
### TABLE 16

**SUMMARY STATISTICS OF THE SAMPLE THAT COMPLETED THE COOPERATIVE GENERAL INDUSTRIAL ARTS TEST**

<table>
<thead>
<tr>
<th></th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Construction</td>
<td>Manufacturing</td>
<td>Construction</td>
</tr>
<tr>
<td><strong>Number of Students</strong></td>
<td>25.0</td>
<td>25.0</td>
<td>25.0</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>19.0</td>
<td>25.0</td>
<td>25.0</td>
</tr>
<tr>
<td><strong>Mean (unadjusted)</strong></td>
<td>21.80</td>
<td>26.52</td>
<td>23.08</td>
</tr>
<tr>
<td><strong>Standard Deviation</strong></td>
<td>6.74</td>
<td>7.26</td>
<td>8.34</td>
</tr>
<tr>
<td><strong>Skewness</strong></td>
<td>0.43</td>
<td>-0.41</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Kurtosis</strong></td>
<td>-1.20</td>
<td>-1.18</td>
<td>-1.04</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>21.0</td>
<td>24.0</td>
<td>30.0</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>34.0</td>
<td>35.0</td>
<td>41.0</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>14.0</td>
<td>11.0</td>
<td>11.0</td>
</tr>
<tr>
<td><strong>K-R 20 Reliability Estimate</strong></td>
<td>0.79</td>
<td>0.82</td>
<td>0.86</td>
</tr>
<tr>
<td><strong>Mean Item Difficulty</strong></td>
<td>0.56</td>
<td>0.58</td>
<td>0.54</td>
</tr>
<tr>
<td><strong>Mean Item Discrimination</strong></td>
<td>0.33</td>
<td>0.35</td>
<td>0.43</td>
</tr>
</tbody>
</table>
### TABLE 17

**SUMMARY STATISTICS OF THE CONCOMITANT VARIABLES FOR THE SAMPLE OF STUDENTS THAT COMPLETED THE COOPERATIVE GENERAL INDUSTRIAL ARTS TEST**

<table>
<thead>
<tr>
<th></th>
<th>Total Sample</th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intelligence Quotient</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>100.89</td>
<td>97.44</td>
<td>101.16</td>
<td>108.48</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>15.79</td>
<td>18.66</td>
<td>17.41</td>
<td>14.04</td>
</tr>
<tr>
<td><strong>Social Position</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>45.17</td>
<td>46.64</td>
<td>40.12</td>
<td>43.92</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>19.12</td>
<td>17.51</td>
<td>18.46</td>
<td>19.27</td>
</tr>
</tbody>
</table>
XT₂ = The mean of a sample of 25 that completed the Cooperative General Industrial Arts Test

X₁ = IACP-field evaluation centers
X₂ = IACP-field demonstration centers
X₃ = conventional industrial arts programs
A = Direction of variance "A"
B = Direction of variance "B"

Results of this computational technique are contained in Table 18, which contains the summary table of the two way analysis of covariance for T₃. The adjustment of scores was dependent on intelligence quotient and social position which produced a statistically significant combined F-ratio of 27.42.

Hypothesis 33:

There is no significant difference in the mean achievement level of students enrolled in the first and second year courses of the IACP program in the field evaluation centers, students enrolled in first and second year courses of the IACP program in the field demonstration centers, and students enrolled in first and second year courses of conventional industrial arts programs on the Cooperative General Industrial Arts Test.
### TABLE 18

**TWO-WAY ANALYSIS OF COVARIANCE OF THE COOPERATIVE GENERAL INDUSTRIAL ARTS TEST ADJUSTED FOR TWO CONTROL VARIABLES**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DEGREES OF FREEDOM</th>
<th>MEAN SQUARE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-By Levels</td>
<td>241.6836</td>
<td>1</td>
<td>241.6836</td>
<td>5.23&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>B-Across Programs</td>
<td>75.6836</td>
<td>2</td>
<td>37.8418</td>
<td>0.82</td>
</tr>
<tr>
<td>AB-Interaction</td>
<td>15.6133</td>
<td>2</td>
<td>7.8066</td>
<td>0.17</td>
</tr>
<tr>
<td>Covariates</td>
<td>2536.6250</td>
<td>2</td>
<td>1268.3125</td>
<td>27.42&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Covariate 1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1496.2886</td>
<td>1</td>
<td>1496.2886</td>
<td>32.35&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Covariate 2&lt;sup&gt;c&lt;/sup&gt;</td>
<td>304.2542</td>
<td>1</td>
<td>304.2542</td>
<td>6.58&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>S(AB)-Within cells</td>
<td>6567.9570</td>
<td>142</td>
<td>46.2532</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Significant at the .05 level

<sup>b</sup>Covariate 1—Intelligence Quotient

<sup>c</sup>Covariate 2—Social Position
The hypothesis was rejected as the F-ratio for source A (by levels) was significant at the .05 level of confidence. Source B and interaction effect were not found to be significant.

Analysis: The mean scores for $T_3$ of the sample students enrolled in the six courses were significant in that source A was found to be statistically significant.

Hypotheses 34 through 48

To locate where the differences existed between the six groups, Duncan's new multiple range test was used as described earlier. Table 19 contains a summary of this statistical test for the adjusted means of the six groups.

One of the paired adjusted means was found to be significantly different.

Hypothesis 46:

$$\bar{x}_{T_3}(X_2L_2) = \bar{x}_{T_3}(X_1L_2)$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_6$.

Analysis: The mean score on $T_3$ of students enrolled in "Manufacturing" in the field evaluation centers was significantly higher than of students enrolled in "Manufacturing" in the field demonstration centers.

The analysis of the paired means for $T_3$ supported the non rejection of 14 hypotheses. These hypotheses were:
TABLE 19
ANALYSIS OF THE DIFFERENCE BETWEEN THE ADJUSTED MEANS ON THE
COOPERATIVE GENERAL INDUSTRIAL ARTS TEST
OF THE SIX VARIABLES OF CENTRAL CONCERN

<table>
<thead>
<tr>
<th>Adjusted Means</th>
<th>(1) $X_2 L_2$</th>
<th>(2) $X_3 L_1$</th>
<th>(3) $X_1 L_1$</th>
<th>(4) $X_2 L_2$</th>
<th>(5) $X_3 L_2$</th>
<th>(6) $X_1 L_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_2 L_2$</td>
<td>21.266</td>
<td>22.515</td>
<td>22.701</td>
<td>23.942</td>
<td>24.193</td>
<td>26.023</td>
</tr>
<tr>
<td>$X_3 L_1$</td>
<td>1.249</td>
<td>1.435</td>
<td>2.676</td>
<td>2.927</td>
<td>4.757</td>
<td></td>
</tr>
<tr>
<td>$X_1 L_1$</td>
<td>0.185</td>
<td></td>
<td>1.426</td>
<td>1.677</td>
<td></td>
<td>3.507</td>
</tr>
<tr>
<td>$X_2 L_2$</td>
<td></td>
<td></td>
<td>1.241</td>
<td>1.492</td>
<td>3.322</td>
<td></td>
</tr>
<tr>
<td>$X_3 L_2$</td>
<td></td>
<td></td>
<td>0.251</td>
<td>2.081</td>
<td></td>
<td>1.830</td>
</tr>
<tr>
<td>$X_1 L_2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$R_2 = 3.188$  $R_3 = 3.371$  $R_4 = 3.461$  $R_5 = 3.580$  $R_6 = 3.648$

*aSignificant at the .05 level*
The analysis of data of the sample of students that completed the Cooperative General Industrial Arts Test revealed that the six groups were different in the level of cognitive achievement. However this difference was minimal in that the tested paired means, with one exception, were not statistically significant.

The General Scale of Attitudes of Junior High School Industrial Arts

Hypotheses 49 through 54 dealt with scores of students that
completed the General Scale of Attitudes of Junior High School Industrial Arts ($T_4$). A random sample of 150 was drawn, 25 for each of the six groups investigated. Table 20 contains the summary statistics of scale scores obtained from the six groups in the sample. An examination of the table showed that the six groups had a range of 15 points in mean scores and standard deviations ranging from a high of 21.01 to a low of 16.36. The overall median scores for the groups varied by 6 points. The reliability estimates derived using the Kuder-Richardson formula 8 ranged from 0.82 to 0.84.

A summary of the control variables for the sample of students that completed $T_4$ is contained in Table 21. The total sample had a mean intelligence quotient of 100.61 and a standard deviation of 15.54. The social position mean was affixed at 43.89 with a standard deviation range from 20.62 for Industrial Arts I students to 13.14 for Industrial Arts II students.

**Hypothesis 49**

Hypothesis 49 was tested using the same procedure as described for hypotheses 1, 17, and 33. Computer cards were punched and processed using the BMD X69 program. The following matrix is a conceptual representation of the samples tested.
<table>
<thead>
<tr>
<th></th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Construction</td>
<td>Manuf</td>
<td>Construction</td>
</tr>
<tr>
<td>Number of Students</td>
<td>25.0</td>
<td>25.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Median</td>
<td>205.0</td>
<td>207.0</td>
<td>202.0</td>
</tr>
<tr>
<td>Mean (unadjusted)</td>
<td>208.56</td>
<td>207.96</td>
<td>198.16</td>
</tr>
<tr>
<td>Range</td>
<td>64.0</td>
<td>68.0</td>
<td>94.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>245.0</td>
<td>241.0</td>
<td>233.0</td>
</tr>
<tr>
<td>Minimum</td>
<td>181.0</td>
<td>173.0</td>
<td>139.0</td>
</tr>
<tr>
<td>K - R Reliability Estimate</td>
<td>0.84</td>
<td>0.82</td>
<td>0.82</td>
</tr>
</tbody>
</table>
### TABLE 21

**Summary Statistics of the Concomitant Variables for the Sample of Students That Completed the General Scale of Attitudes of Junior High School Industrial Arts**

<table>
<thead>
<tr>
<th></th>
<th>Total Sample</th>
<th>IACP - Field Evaluation Centers</th>
<th>IACP - Field Demonstration Centers</th>
<th>Conventional Industrial Arts Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Construction</td>
<td>Manufacturing</td>
<td></td>
</tr>
<tr>
<td>Intelligence Quotient Mean</td>
<td>100.61</td>
<td>98.44</td>
<td>105.50</td>
<td>109.96</td>
</tr>
<tr>
<td>Social Position Mean</td>
<td>43.89</td>
<td>45.80</td>
<td>39.88</td>
<td>34.40</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>17.87</td>
<td>16.28</td>
<td>14.78</td>
<td>17.34</td>
</tr>
</tbody>
</table>
$\bar{X}_{T4}$ = The Mean of a sample of 25 students that completed the Cooperative General Industrial Arts Test

$x_1$ = IACP-field evaluation centers

$x_2$ = IACP-field demonstration centers

$x_3$ = conventional industrial arts programs

$A$ = Direction of variance "A"

$B$ = Direction of variance "B"

Results of the computational technique are contained in Table 22, which is the summary table of the two way analysis of covariance for $T_4$. The adjustment of scores were not dependent on either of the control variables, intelligence quotient and social position, at a statistically significant level.

Hypothesis 49:

There is no significant difference in the mean achievement level of students enrolled in the first and second year courses of the IACP program in the field evaluation centers, students enrolled in first and second year courses of the IACP program in the field demon-
TABLE 22
TWO-WAY ANALYSIS OF COVARIANCE OF THE GENERAL SCALE OF ATTITUDES
OF JUNIOR HIGH SCHOOL INDUSTRIAL ARTS ADJUSTED
FOR TWO CONTROL VARIABLES

(N = 150)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DEGREES OF FREEDOM</th>
<th>MEAN SQUARE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A- By Levels</td>
<td>230.4453</td>
<td>1</td>
<td>230.4453</td>
<td>0.56a</td>
</tr>
<tr>
<td>B- Across Programs</td>
<td>1861.1758</td>
<td>2</td>
<td>930.5879</td>
<td>2.25a</td>
</tr>
<tr>
<td>AB-Interaction</td>
<td>136.2109</td>
<td>2</td>
<td>68.1055</td>
<td>0.16a</td>
</tr>
<tr>
<td>Covariates</td>
<td>970.9375</td>
<td>2</td>
<td>485.4688</td>
<td>1.17a</td>
</tr>
<tr>
<td>Covariate 1</td>
<td>911.4910</td>
<td>1</td>
<td>911.4910</td>
<td>2.20a</td>
</tr>
<tr>
<td>Covariate 2</td>
<td>63.6703</td>
<td>1</td>
<td>63.6703</td>
<td>0.15a</td>
</tr>
<tr>
<td>S(AB)-Within Cells</td>
<td>58815.2500</td>
<td>142</td>
<td>414.1919</td>
<td></td>
</tr>
</tbody>
</table>

*aNot significant at the .05 level
bCovariate 1--Intelligence Quotient
cCovariate 2--Social Position
stratification centers, and students enrolled in first and second year courses of conventional industrial arts programs on the General Scale of Attitudes of Junior High School Industrial Arts.

The hypothesis was not rejected as the F-ratio scores for source A, source B, and interaction were not statistically significant at the .05 level of confidence.

Analysis: The mean score for $T_4$ of the sample of students enrolled in the six courses were not significantly different.

Hypotheses 50 through 64

To locate where, if any, the differences existed between pairs of means for the six groups, Duncan's new multiple range test was used as described earlier in the chapter. Table 23 contains a summary of this statistical test for the adjusted means of the six groups.

One of the paired adjusted means was found to be statistically significant.

Hypothesis 57:

$$\bar{x}_{T4}(X_{2L1}) = \bar{x}_{T4}(X_{3L2})$$

The hypothesis was rejected as the difference between the adjusted means was larger than the shortest significant range for $R_6$.

Analysis: The mean score on $T_4$ of students enrolled in "Manufacturing" in the field evaluation centers was significantly higher than of students enrolled in "Construction" in the field demonstration centers.
<table>
<thead>
<tr>
<th>Adjusted Means</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( X_2L_1 )</td>
<td>199.476</td>
<td>201.602</td>
<td>205.916</td>
<td>208.160</td>
<td>208.551</td>
<td>211.135</td>
</tr>
<tr>
<td>( X_2L_2 )</td>
<td>199.476</td>
<td>2.126</td>
<td>6.440</td>
<td>8.684</td>
<td>9.075</td>
<td>11.659a</td>
</tr>
<tr>
<td>( X_3L_1 )</td>
<td>201.602</td>
<td>4.314</td>
<td>6.558</td>
<td>6.949</td>
<td>9.533</td>
<td></td>
</tr>
<tr>
<td>( X_3L_2 )</td>
<td>205.916</td>
<td>2.243</td>
<td>2.635</td>
<td>5.219</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( X_1L_1 )</td>
<td>208.160</td>
<td>0.392</td>
<td>2.976</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( X_1L_2 )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.584</td>
<td></td>
</tr>
</tbody>
</table>

\[ R_2 = 9.540 \quad R_3 = 10.090 \quad R_4 = 10.452 \quad R_5 = 10.712 \quad R_6 = 10.916 \]

\(^a\text{Significant at the .05 level}\)
The analysis of the paired means for $T_4$ supported the non-rejection of 14 hypotheses. These hypotheses were:

50. $\bar{X}_4(X_{1L1}) = \bar{X}_4(X_{1L2})$ Not rejected
51. $\bar{X}_4(X_{1L1}) = \bar{X}_4(X_{2L1})$ Not rejected
52. $\bar{X}_4(X_{1L1}) = \bar{X}_4(X_{2L2})$ Not rejected
53. $\bar{X}_4(X_{1L1}) = \bar{X}_4(X_{3L1})$ Not rejected
54. $\bar{X}_4(X_{1L1}) = \bar{X}_4(X_{3L2})$ Not rejected
55. $\bar{X}_4(X_{2L1}) = \bar{X}_4(X_{2L2})$ Not rejected
56. $\bar{X}_4(X_{2L1}) = \bar{X}_4(X_{3L1})$ Not rejected
58. $\bar{X}_4(X_{2L1}) = \bar{X}_4(X_{1L2})$ Not rejected
59. $\bar{X}_4(X_{3L1}) = \bar{X}_4(X_{3L2})$ Not rejected
60. $\bar{X}_4(X_{3L1}) = \bar{X}_4(X_{1L2})$ Not rejected
61. $\bar{X}_4(X_{3L1}) = \bar{X}_4(X_{2L2})$ Not rejected
62. $\bar{X}_4(X_{2L2}) = \bar{X}_4(X_{1L2})$ Not rejected
63. $\bar{X}_4(X_{2L2}) = \bar{X}_4(X_{3L2})$ Not rejected
64. $\bar{X}_4(X_{1L2}) = \bar{X}_4(X_{3L2})$ Not rejected

Section Summary
The analysis of data of the sample of students who completed the General Scale of Attitudes of Junior High School Industrial Arts revealed that the six groups were not statistically different in the overall level of attitudes as measured by the attitude scale. In comparing paired adjusted means, however, students enrolled in "Manufacturing" in the field evaluation centers scored significantly higher than did students enrolled in "Construction" in the field demonstration centers.
Sub-Problem One

Sub-problem one was concerned with whether or not a relationship existed between achievement as compared with intelligence quotient, social position, and geographical location of students enrolled in the IACP program in the field evaluation centers. For this problem, four hypotheses were posed.

Hypotheses 65 and 66

The first step following data collection in the investigation of the relationship between geographical location and achievement was the selection of two samples. One sample included test scores and control variables of "Construction" students that completed The World of Construction Achievement Test-Comprehensive Exam and the other included test scores and control variables of "Manufacturing" students that completed The World of Manufacturing Achievement Test-Comprehensive Exam. Each sample totaled 75, 15 of which were randomly selected from data of students in each of the field evaluation centers in the target population.

The data cards for these samples were processed through the BMD 03V program at The Ohio State University Data Processing Center. Results for the "Construction" students are contained in Table 24 and for the "Manufacturing" students in Table 25. Included in these summary tables are one way analyses of covariance for each sample.
Table 24

One Way Analysis of Covariance Adjusted for Two Covariants
For the World of Construction Achievement
Test-Comprehensive Exam

(N=75)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DEGREES OF FREEDOM</th>
<th>MEAN SQUARE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation Centers</td>
<td>129.3047</td>
<td>4</td>
<td>32.3262</td>
<td>.46&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Within Cells</td>
<td>4812.1133</td>
<td>68</td>
<td>70.7664</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Not significant at the .05 level
<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DEGREES OF FREEDOM</th>
<th>MEAN SQUARE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation Centers</td>
<td>58.6016</td>
<td>4</td>
<td>14.6504</td>
<td>.36 a</td>
</tr>
<tr>
<td>Within Cells</td>
<td>2753.3047</td>
<td>68</td>
<td>40.4898</td>
<td></td>
</tr>
</tbody>
</table>

aNNot significant at the .05 level
Hypothesis 65:

There is no significant difference in the mean achievement level on The World of Construction Achievement Test-Comprehensive Exam of students enrolled in the first year course of the IACP program in the field evaluation centers: Austin, Texas (R₁); Chicago-Evanston, Illinois (R₂); Cincinnati, Ohio (R₃); Long Beach, California (R₄); and Trenton-Hamilton Township-New Brunswick, New Jersey (R₅).

Analysis: The hypothesis was not rejected as the F-ratio of 0.46 (Table 24) for the mean scores of students in the five evaluation centers was not found to be significant at the .05 level of confidence.

Hypothesis 66:

There is no significant difference in the mean achievement level on The World of Manufacturing Achievement Test-Comprehensive Exam of students enrolled in the second year course of the IACP program in the field evaluation centers; Austin, Texas (R₁); Chicago-Evanston, Illinois (R₂); Cincinnati, Ohio (R₃); Long Beach, California (R₄); and Trenton-Hamilton Township-New Brunswick, New Jersey (R₅).

Analysis: The hypothesis was not rejected as the F-ratio of 0.36 (Table 25) for the mean scores of students in the five evaluation centers was not found to be significant at the .05 level of confidence.

Hypotheses 67 and 68

For the investigation of whether or not a relationship existed between the control variables (intelligence quotient and social position) and achievement, two samples of 50 were randomly drawn. One sample included test scores and control variables of
"Construction" students that completed The World of Construction Achievement Test-Comprehensive Exam and the other included test scores and control variables of "Manufacturing" students that completed The World of Manufacturing Achievement Test-Comprehensive Exam.

The variables for these samples were placed on data cards and processed using the BMD 01S program at The Ohio State University. This program is a multiple regression analysis statistical procedure.

Hypothesis 67:

The variables of intelligence quotient and social position are not significant predictors of performance in The World of Manufacturing Test-Comprehensive Exam by students enrolled in "The World of Construction."

The results of the multiple regression analysis for this hypothesis are contained in Table 26.

Analysis: The hypothesis was rejected as the F-ratio of 10.07 was found to be significant at the .05 level of confidence.

Hypothesis 68:

The variables of intelligence quotient and social position are not significant predictors of performance on The World of Manufacturing Test-Comprehensive Exam by students enrolled in "The World of Manufacturing."

The results of the multiple regression analysis for this hypothesis are contained in Table 27.
### TABLE 26

**ANALYSIS OF VARIANCE FOR THE MULTIPLE REGRESSION ANALYSIS OF THE WORLD OF CONSTRUCTION ACHIEVEMENT TEST-COMPREHENSIVE EXAM SCORES, INTELLIGENCE QUOTIENT AND SOCIAL POSITION**

(N=50)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DEGREES OF FREEDOM</th>
<th>MEAN SQUARE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1811.563</td>
<td>2</td>
<td>905.781</td>
<td>10.07&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Residual</td>
<td>4228.406</td>
<td>47</td>
<td>89.966</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant at the .05 level


TABLE 27
ANALYSIS OF VARIANCE FOR THE MULTIPLE REGRESSION ANALYSIS OF THE
WORLD OF MANUFACTURING ACHIEVEMENT TEST-COMPREHENSIVE EXAM
SCORES, INTELLIGENCE QUOTIENT AND SOCIAL POSITION

(N=50)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DEGREES OF FREEDOM</th>
<th>MEAN SQUARE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1898.146</td>
<td>2</td>
<td>949.073</td>
<td>13.26&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Residual</td>
<td>3363.350</td>
<td>47</td>
<td>71.561</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant at the .05 level
Analysis: The hypothesis was rejected as the F-ratio of 13.26 was found to be significant at the .05 level of confidence.

Section Summary

The determination of relationship between the tests, $T_1$ and $T_2$, and geographical region, intelligence quotient and social position was the central concern of this section. The analysis contained within this section showed that a statistically significant positive relationship does exist between the two variables $T_1$ and $T_2$ and the control variables of intelligence quotient and social position. The geographical region of the students in the sample was not a significant predictor of the adjusted scores on $T_1$ and $T_2$.

Sub-Problem Two

Sub-problem two focused on the comparison of the achievement of students enrolled in "The World of Construction" course with students enrolled in "The World of Manufacturing" concerning the total body of knowledge of industry for the two year course sequence. One hypothesis was posed for this question.

Hypothesis 69

The sample for this hypothesis consisted of 100, equally divided between students enrolled in "Construction" and students enrolled in "Manufacturing." Within each group, the sample was stratified by randomly selecting 25 scores of students that com-
pleted The World of Construction Achievement Test-Comprehensive Exam and 25 that completed The World of Manufacturing Achievement Test-Comprehensive Exam. The following matrix is a conceptual representation of the samples tested.

\[
\begin{array}{c|c}
X_1 & \bar{X}_T_1 & \bar{X}_T_2 \\
L_1 & \bar{X}_T_1 & \bar{X}_T_2 \\
L_2 & \bar{X}_T_1 & \bar{X}_T_2 \\
\end{array}
\]

\(\bar{X}_T_1\) = The mean of a sample of 25 that completed The World of Construction Achievement Test-Comprehensive Exam

\(\bar{X}_T_2\) = The mean of a sample of 25 that completed The World of Manufacturing Achievement Test-Comprehensive Exam

\(X_1\) = IACP in the field evaluation centers

\(L_1\) = "Construction" classes

\(L_2\) = "Manufacturing" classes

Summary statistics for the students enrolled in The World of Construction in the sample revealed a median score of 25 and a mean score of 26.38 with a standard deviation of 8.22. The students in the sample enrolled in The World of Manufacturing appeared to score higher on the test with a median of 28 and a mean and standard deviation of 31.18 and 10.74 respectfully.

The data cards for the two samples were processed through
Hypothesis 69:

There is no significant difference in the mean achievement level on The World of Construction Achievement Test-Comprehensive Exam and The World of Manufacturing Achievement Test-Comprehensive Exam of students enrolled in "The World of Construction" as compared with the mean achievement level on The World of Construction Achievement Test-Comprehensive Exam and The World of Manufacturing Achievement Test-Comprehensive Exam of students enrolled in "The World of Manufacturing".

Analysis: The hypothesis was not rejected as the F-ratio of 0.50 between groups was found not be to significant at the .05 level of confidence.

Chapter Summary

This chapter contained the findings of the data of the study for each of the hypotheses tested. In addition, the summary statistics were detailed for each sample, the statistical procedures employed were explained, and an analysis was made of the findings for each hypothesis. A discussion of the implications of these results is included in Chapter V.
Table 28

One way analysis of covariance of the achievement of "construction" students compared with "manufacturing" students on the combined criterion measures T1 and T2

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>29.2813</td>
<td>1</td>
<td>29.2813</td>
<td>0.50&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Within Cells</td>
<td>5580.5234</td>
<td>96</td>
<td>58.1305</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Not significant at the .05 level
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this chapter is threefold. First the study will be summarized by restating the problem, highlighting what transpired in the coverage of the review of literature, and outlining the procedures and methods employed. Second, conclusions will be detailed, based on the findings of the study. Third, recommendations will be set forth as deemed appropriate for concluding this evaluation study.

SUMMARY

In the period from 1965 to 1971, a group of men head-quartered at The Ohio State University provided the leadership for a two year innovative industrial arts curriculum sequence for the junior high school. This effort, entitled the Industrial Arts Curriculum Project (IACP), during that time was primarily sponsored by the United States Office of Education with a total expenditure that exceeded 2.2 million dollars. One of the principal undertakings of the project was a comprehensive evaluation system that monitored the progress of the project and provided viable alternative for decision making. During the last year of the projects' existence, the 1970-71 academic year, evaluation
was focused toward the collection of evidence that attested the
worth of the instructional system that was developed. This study
was one part of that total effort.

Restatement of the Problem

The major problem of this investigation was to compare
cognitive achievement and affective behavior of 1) students
enrolled in the two year program developed by the IACP in five
field evaluation centers, 2) students enrolled in the IACP
program in five field demonstration centers, and 3) students
enrolled in conventional junior high school industrial arts
programs in which the IACP instructional system was not utilized.
In addition, two related subproblems were included in this
investigation. These were:

1. To determine if there is a relationship between
   achievement as compared with intelligence quotient,
   social position, and geographical location of students
   enrolled in the two year program developed by the IACP
   as institutionalized in five field evaluation centers.

2. To compare the achievement of students enrolled in
   "The World of Construction" course with students
   enrolled in "The World of Manufacturing" course
   concerning the total body of knowledge of industry
   as established in "The Rationale and Structure of
   Industrial Arts Subject Matter" (Towers, Lux, and
Review of the Literature

The literature review (Chapter II) for the study focused on four major areas. The central purpose of this chapter was to inform the reader concerning the major aspects of the study.

The first section helped set the framework of the study by reviewing the developmental history of the IACP innovative instructional program. This commenced with a brief review of the rationale for industrial arts. Following this, the curriculum development, field testing and revision processes of the project were set forth. This was followed by a summary of the IACP evaluation system in order to show the relationship of this study to the overall goals of the project evaluation endeavors.

The second section focused on conventional industrial arts education, the purpose of which was to set parameters on the practice of industrial arts education as it exists in the majority of school systems in the United States. The section coverage was approached in two ways: 1) the body of knowledge was examined and 2) the objectives and goals were investigated.

Section three briefly reviewed selected elements of evaluation methodology in reference to the procedures established for this study. The section did not include a comprehensive coverage of the topics covered but instead provided a general introduction to the topics. Attitude measurement and instruments as employed in the study comprised the first two topics. The remaining four topics dealt with achievement tests and their use in evaluation and program comparisons.
The final section of the chapter focused on research studies similar to the one being reported. In the reviews of these studies, emphasis was focused on the procedures and methodology employed.

**Procedure of the Study**

For this evaluation study, a post test-only method was used with intact classroom groups. The study was concerned with three different groups: two groups which were enrolled in IACP programs and one group which was enrolled in conventional industrial arts programs. Variables investigated in this study were adjusted statistically by using analysis of covariance. This statistical procedure was used for the purpose of adjusting data for the three groups to control for any initial variations existing in known factors related to the variables under study.

Six variables of central concern were identified for the study:

1. "The World of Construction" course as institutionalized in the IACP field evaluation centers ($X_1L_1$).
2. "The World of Manufacturing" course as institutionalized in the IACP field evaluation centers ($X_1L_2$).
3. "The World of Construction" course as institutionalized in the IACP field demonstration centers ($X_2L_1$).
4. "The World of Manufacturing" course as institutionalized in the IACP field demonstration centers ($X_2L_2$).

5. "Industrial Arts I" which consists of courses designed for initial experiences in one or more of the conventional industrial arts areas of woodworking, metalworking, electricity, and drafting ($X_3L_1$).

6. "Industrial Arts II" which consists of courses designed for students that have had one year of industrial arts education and focus primarily on one or more of the conventional industrial arts areas of woodworking, metalworking, electricity and drafting ($X_3L_2$).

For the evaluation of students participating in the study, four evaluation instruments were employed:

1. The World of Construction Achievement Test-Comprehensive Exam ($T_1$).

2. The World of Manufacturing Achievement Test-Comprehensive Exam ($T_2$).

3. Cooperative General Industrial Arts Test-Form A ($T_3$).

4. General Scale of Attitudes of Junior High School Industrial Arts ($T_4$).
Scores for two control variables were obtained for the students that participated in the study. These were scores of intelligence quotient and social position.

The design for the study was a post test-only design for six groups. Within each group the students were randomly assigned to complete one of the evaluation instruments. The design is conceptually illustrated below:

The target population consisted of intact classes of subjects enrolled in the six groups as previously described.
The following matrix details the number of subjects that participated in the study for which usable data was obtained:

\[
\begin{array}{ccc}
X_1 & X_2 & X_3 \\
L_1 & 910 & 333 & 457 \\
L_2 & 805 & 278 & 345 \\
\end{array}
\]

A complete description of the population and its delimitations, and methods of data collection are described in Chapter III.

Thirteen research questions were posed in order to investigate the major problem of this study and the two sub-problems. These were:

1. Is there a difference by levels in the mean scores on The World of Construction Achievement Test-Comprehensive Exam \( (T_1) \) of students enrolled in the IACP program in the field evaluation centers \( (X_1L_1 \text{ and } X_1L_2) \) as compared with students enrolled in the IACP program in the field demonstration centers \( (X_2L_1 \text{ and } X_2L_2) \) and students enrolled in conventional industrial arts courses \( (X_3L_1 \text{ and } X_3L_2) \)?

2. What difference, if any, in the performance on The World of Construction Achievement Test-Comprehensive Exam exists between pairs of the six variables of central concern?

3. Is there a difference by levels in the performance on The World of Manufacturing Achievement Test-Comprehensive Exam \( (T_2) \) of students enrolled in the IACP program in the field evaluation
centers (X1L1 and X1L2) as compared with students enrolled in the IACP program in the field demonstration centers (X2L1 and X2L2) and students enrolled in conventional industrial arts courses (X3L1 and X3L2)?

4. What difference, if any, in the performance on The World of Manufacturing Achievement Test-Comprehensive Exam exists between pairs of the six variables of central concern?

5. Is there a difference by levels in the performance on the Cooperative General Industrial Arts Test (T3) of students enrolled in the IACP program in the field evaluation centers (X1L1 and X1L2) as compared with students enrolled in the IACP program in the field demonstration centers (X2L1 and X2L2) and students enrolled in conventional industrial arts courses (X3L1 and X3L2)?

6. What difference, if any, in the performance on the Cooperative General Industrial Arts Test exists between pairs of the six variables of central concern?

7. Is there a difference by levels in the performance on the General Scale of Attitudes of Junior High School Industrial Arts (T4) of students enrolled in the IACP program in the field evaluation centers (X1L1 and X1L2) as compared with students enrolled in the IACP program in the field demonstration centers (X2L1 and X2L2) and students enrolled in conventional industrial arts courses (X3L1 and X3L2)?
8. What difference, if any, in the performance on the General Scale of Attitudes of Junior High School Industrial Arts exists between pairs of the six variables of central concern?

9. Is there a difference in the performance on The World of Construction Achievement Test-Comprehensive Exam ($T_1$) of students enrolled in "The World of Construction" stratified by geographic location ($R_x$)?

10. Is there a difference in the performance on The World of Manufacturing Achievement Test-Comprehensive Exam ($T_2$) enrolled in "The World of Manufacturing" when stratified by geographic location ($R_x$)?

11. Is there a significant relationship between the performance on The World of Construction Test-Comprehensive Exam, intelligence quotient, and social position of students enrolled in "The World of Construction"?

12. Is there a significant relationship between the performance on The World of Manufacturing Test-Comprehensive Exam, intelligence quotient, and social position of students enrolled in "The World of Manufacturing"?

13. Is there a difference in the collective performance on The World of Construction Achievement Test-Comprehensive Exam and The World of Manufacturing Achievement Test-Comprehensive Exam of students enrolled in "The World of Construction" as compared with the collective performance on The World of Construction Achievement Test-Comprehensive Exam and The World of Manufacturing Achievement Test-Comprehensive Exam of students enrolled in "The World of Manufacturing"?
From the foregoing questions, 69 statistical hypotheses were formulated which provided the framework for the data sampling, testing, and analysis procedures. Sampling procedures for the study consisted of randomly selecting data for individual students within each group investigated as warranted by the hypotheses.

Following the selection of samples for the study, the answer sheets for the four dependent variables were optically scanned and scored. Next the data were subjected to an item analysis program. This program produced a series of summary statistics which included the mean, median, mode, standard deviation, skewness, kurtosis, and Kuder-Richardson reliability estimates.

Computer data cards were key punched to contain the scores for the dependent variables and concomitant variables for each student. These cards served as the data decks for the computer programs that were used to test the hypotheses of the study. Statistical techniques used for these tests included analysis of covariance, Duncan's new multiple range test and a stepwise multiple regression analysis. The application of these statistics in testing the hypotheses was detailed in Chapter IV.

Conclusions

The data obtained from this investigation were analyzed according to acceptable statistical methods. From this analysis,
several findings were drawn and conclusions made. This section details the findings and conclusions of the study, first those of the major problem and then of the two sub-problems.

The World of Construction Achievement Test-Comprehensive Exam

Several findings were drawn from the analysis of data of the six samples of students that completed The World of Construction Achievement Test-Comprehensive Exam (T1):

1. Test T1 appeared to discriminate between the six groups. On the fifty item test, the unadjusted mean scores ranged from high of 32.40 to a low of 20.28. The median scores had a similar dispersion from 33 to 20.

2. Test T1 seemed to have better discrimination power for students enrolled in the IACP program as compared with those in conventional industrial arts. The standard deviations for the four samples of students enrolled in the IACP programs were about the same, ranging from 10.50 to 11.33. However, the standard deviations for the conventional industrial arts student samples (7.04 and 7.62) were markedly different. The mean item discrimination for the four samples of students enrolled in the IACP program ranged from 0.53 to 0.57 while those of the conventional industrial arts courses were 0.35 to 0.39. The reliability estimates for the IACP samples (0.92 to 0.93) as compared with the conventional industrial arts samples (0.78 to 0.82) were also markedly different.
3. The two way analysis of covariance for the six groups revealed that the adjusted scores on $T_1$ were significantly dependent on the intelligence quotient control variable ($F=46.49$) but not on the social position control variable ($F=0.03$).

4. The two way analysis of covariance revealed that variance B (across programs) had a significant F-ratio of 7.31, but variance A (by levels) and AB interaction were nonsignificant with F-ratio values of 0.74 and 2.60 respectfully.

5. The comparisons of the adjusted paired means for the six sample groups revealed that:
   a. the IACP "Construction" students had a significantly higher achievement level than did students enrolled in conventional industrial arts programs.
   b. students enrolled in Manufacturing in the field evaluation centers did as well as students enrolled in "Construction" in both field center settings. However, students enrolled in Manufacturing in the field demonstration centers scored significantly lower than did students enrolled in Construction in the field demonstration centers. One possible cause for this unexpected finding might be that many students that were enrolled in Manufacturing in the field demonstration centers did not complete the Construction course prior to enrolling in Manufacturing. The field
demonstration centers were not required to offer the Construction and Manufacturing course in sequential order as were the field evaluation centers.

Several conclusions seemed to be warranted from the findings pertaining to the six sample groups that completed The World of Construction Achievement Test-Comprehensive Exam ($T_1$):

1. The test instrument was a highly reliable instrument and provided adjusted mean scores that statistically discriminated between the groups.

2. Achievement scores as measured on $T_1$ were not significantly dependent on the social position values assigned the students. However the achievement scores were significantly dependent on the intelligence quotient scores.

3. The students enrolled in Construction had a higher level of cognitive achievement than did students enrolled in conventional industrial arts programs as measured by $T_1$.

4. After one year had elapsed since being enrolled in Construction, the students that completed the two year IACP sequence as institutionalized in the field evaluation centers performed equally well on $T_1$ with students taking the test while enrolled in Construction.

The World of Manufacturing Achievement Test - Comprehensive Exam

From the analysis of data of the six samples of students that completed The World of Manufacturing Achievement Test-Comprehensive
Exam \((T_2)\), several findings were made:

1. Test \(T_2\) appeared to discriminate between the six groups. On the fifty item test, the unadjusted mean scores ranged from a high of 25.36 to a low of 16.48. The median scores had a similar dispersion from 25 to 16.

2. Test \(T_2\) seemed to have better discrimination power for students enrolled in Manufacturing as compared with students enrolled in Construction and conventional industrial arts. The standard deviations for the two groups of Manufacturing students were 9.32 and 11.07. However, the standard deviations for the other groups (Construction and conventional industrial arts) were markedly lower ranging from 5.06 to 6.82. The mean item discrimination for the Manufacturing students were 0.46 and 0.57 while the other four groups ranged from 0.26 to 0.34. The reliability estimates for the Manufacturing (0.89 and 0.92) as compared with the Construction and conventional industrial arts students (0.60 to 0.78) also differed markedly.

3. The two way analysis of covariance for the six groups revealed that the adjusted scores on \(T_2\) were significantly dependent on the intelligence quotient control variable \((F=44.59)\) but not on the social position control variable \((F=0.40)\).

4. The two-way analysis of covariance revealed that variance A (by levels) and variance B (across programs) had significant F-ratios of 9.43 and 3.22 respectively. The F-ratio of 1.20 for AB-interaction was not significant.
5. The comparison of the adjusted paired means for the six sample groups showed that the Manufacturing students in both the field evaluation and demonstration center settings had significantly higher adjusted mean achievement levels than did students enrolled in Construction and conventional industrial arts. This finding was expected in that Test $T_2$ was designed to measure the cognitive content of The World of Manufacturing course which the Construction and conventional industrial arts student did not take.

Several conclusions seemed to be warranted from the findings pertaining to the six samples that completed The World of Manufacturing Achievement Test-Comprehensive Exam ($T_2$):

1. The test although not a highly reliable instrument did provide adjusted mean scores that statistically discriminated between the six sample groups.

2. Achievement scores as measured on $T_2$ were not significantly dependent on the social position values assigned the students. However the achievement scores for $T_2$ were significantly dependent on the intelligence quotient scores.

3. The students enrolled in Manufacturing had a higher level of cognitive achievement than did students enrolled in Construction as measured by $T_2$.

4. The students enrolled in Manufacturing had a higher level of cognitive achievement on $T_2$ than did the conventional industrial arts students.
The Cooperative General Industrial Arts Test

Several findings were derived from the analysis of data of the six samples of students that completed the Cooperative General Industrial Arts Test ($T_3$):

1. $T_3$ did not appear to discriminate between the six groups. On the fifty item test, the unadjusted mean scores for the six groups had a range of less than five points (20.96 to 25.20). The median scores were similarly dispersed with a range of 25 for the high three groups to 19 for the low group. The standard deviations for the groups were also about the same ranging from 0.67 to 8.34. The reliability estimates were somewhat similar with a high of 0.86 to a low of 0.78. All six groups had low mean item discrimination indexes (0.33 to 0.43).

2. The two way analysis of covariance for the six groups revealed that the adjusted scores on $T_3$ were significantly dependent on both the intelligence quotient and social position control variables with F-ratios of 32.35 and 6.58 respectively.

3. The two way analysis of covariance revealed that variance A (by levels) had a significant F-ratio of 5.23 but variance B (across programs) and AB interaction were not significant with F-ratio values of 0.82 and 0.17 respectively.

4. The comparisons of the adjusted paired means for the six sample groups revealed that only one pair of adjusted means were significantly different — that being the Manufacturing students in the field evaluation centers which performed significantly higher
than did Manufacturing students in the field demonstration centers. Some possible explanations that might account for the overall lack of discrimination between the six sample groups that completed $T_3$ are:

a. The cognitive content as measured by $T_3$ (conventional industrial arts concepts) was mastered by students that were enrolled in the IACP instructional system at the same level as that of students enrolled in the conventional industrial arts programs.

b. $T_3$ measured something other than the cognitive achievement of conventional industrial arts subject matter.

c. The items on $T_3$ were not technically well written and failed to discriminate between students with high and low achievement levels.

Three conclusions seemed to be warranted from the findings pertaining to the six sample groups that completed the Cooperative General Industrial Arts Test ($T_3$):

1. The test, although having a respectable reliability estimate did not provide adjusted mean scores that statistically discriminated between students enrolled in the IACP program and students enrolled in conventional industrial arts.

2. Achievement scores as measured on $T_3$ were significantly dependent on both the intelligence quotient and social position values assigned the students.

3. Students enrolled in the IACP program performed as well as students enrolled in conventional industrial arts programs
as measured by the Cooperative General Industrial Arts Test when adjusted for two control variables: intelligence quotient and social position.

General Scale of Attitudes of Junior High School Industrial Arts

Several findings were drawn from the analysis of data of the six samples of students who completed the General Scale of Attitudes of Junior High school Industrial Arts ($T_4$):

1. Test $T_4$ did not appear to discriminate between the six groups. On the sixty item test, the unadjusted mean scores for the six groups had a range of 15 points (198.16 to 213.36). The median scores had a smaller range with a high of 210 and 202. However the standard deviations for the groups were relatively large ranging from 16.36 to 21.01. The reliability estimates were quite similar (0.82 to 0.83).

2. The two way analysis of covariance for the six groups revealed that the adjusted scores on $T_4$ were not significantly dependent on the two control variables: intelligence quotient ($F=2.20$) and social position ($F=0.15$).

3. The two way analysis of covariance revealed that variance A (by levels) had a nonsignificant F-ratio of 0.56, variance B (across programs) had a nonsignificant F-ratio of 2.25, and AB interaction was nonsignificant with an F-ratio of 0.16.

4. Only one of the fifteen paired means was found to be significant. Industrial Arts II students scored significantly higher on $T_4$ than did the Construction students in the field
demonstration centers. Two ideas are posed for the overall lack of discrimination between the six sample groups that completed $T_4$:

1. The learning activities of the variables of central concern had similar effects on the students in relation to the degree of affective behavior measured by $T_4$.

2. The test items on $T_4$ failed to discriminate between students with different attitudinal responses.

Two conclusions seemed to be warranted from the findings pertaining to the six samples that completed the General Scale of Attitudes of Junior High School Industrial Arts ($T_4$):

1. $T_4$, although having a good reliability estimate, did not provide adjusted mean scores that statistically discriminated between students enrolled in the IACP program as compared with students enrolled in conventional industrial arts.

2. Attitude scores as measured by $T_4$ were not significantly dependent on either intelligence quotient or social position values assigned the students.

Sub-problem One

Sub-problem one was concerned with whether or not a relationship existed between achievement as compared with intelligence quotient, social position, and geographical location of students enrolled in the IACP program in the field evaluation center.
Several findings were drawn from the analysis of data pertaining to this problem:

1. In comparing the adjusted means of $T_1$ for the Construction students enrolled in the five field evaluation centers, a non-significant F-ratio of 0.457 was computed.

2. In comparing the adjusted means of $T_2$ for the Manufacturing students enrolled in the five evaluation centers, a nonsignificant F-ratio of 0.36 was computed.

3. The results of the multiple regression analysis to determine whether or not a relationship existed between $T_1$ and the control variables of intelligence quotient and social position of students enrolled in Construction revealed a significant F-ratio value of 10.07.

4. The results of the multiple regression analysis to determine whether or not a relationship existed between $T_2$ and the control variables of intelligence quotient and social position of students enrolled in Manufacturing revealed a significant F-ratio value of 13.26.

Two conclusions seemed to be warranted from the findings of the data analysis for sub-problem one:

1. The variables of social position and intelligence quotient were valid positive predictors of achievement of students enrolled in "The World of Construction" as measured by The World of Construction Achievement Test-Comprehensive Exam and of students enrolled in "The World of Manufacturing" as measured by The World of Manufacturing Achievement Test-Comprehensive Exam.
2. The geographical location of students was not a valid predictor of achievement of students enrolled in "The World of Construction" as measured by The World of Construction Achievement Test-Comprehensive Exam when adjusted for intelligence quotient and social position and of students enrolled in "The World of Manufacturing" as measured by The World of Manufacturing Achievement Test-Comprehensive Exam when adjusted for intelligence quotient and social positions.

Sub-problem Two

Sub-problem two focused on the comparison of achievement of students enrolled in Construction with those enrolled in Manufacturing concerning the combined scores of $T_1$ and $T_2$. The findings drawn from the analysis of data pertaining to this problem were:

1. The combined unadjusted scores on $T_1$ and $T_2$ seemed to be different for the two groups. The students enrolled in Construction had a combined mean score of 26.38 and a median score of 25 while the students in Manufacturing had a higher combined mean score of 31.78 and a median score of 28. The standard deviations of the two groups did not appear to vary markedly (8.22 for Construction students as opposed to 10.74 for Manufacturing students).

2. The one way analysis of covariance for the two groups revealed, however, that the F-ratio of 0.50 for the combined scores on $T_1$ and $T_2$ was not statistically significant.
The conclusion that seemed to be warranted from findings of the data analysis for sub-problem two was:

There was no difference in the collective performance on The World of Construction Achievement Test-Comprehensive Exam and The World of Manufacturing Achievement Test-Comprehensive Exam of students enrolled in "The World of Construction" as compared with collective performance on The World of Manufacturing Achievement Test-Comprehensive Exam of students enrolled in "The World of Manufacturing".

Recommendations

The recommendations that follow are made in light of the findings and conclusions of this study. They are divided into two groups: 1) recommendations pertaining to the need to further analyze the broad problem area of this study and 2) recommendations concerning the meaning of the findings and conclusions in terms of the teaching-learning process.

Recommendations for Continued Research

1. The problem of determining the amount of cognitive achievement in disparate programs should be further investigated using experimental designs that would control for problems of internal and external validity not controlled in this study.

2. A comprehensive evaluation instrument should be developed that would measure the achievement of the total domain of objectives
of industrial arts education. When developed, an instrument of this type would be highly useful in evaluating achievement performance of various instructional systems on the same basis.

3. Experimental investigations should be made of individual and additive effects of the variables of central concern of this study in the cognitive, affective, and psychomotor domains of knowledge.

4. Longitudinal studies should be conducted that would focus on retention and reinforcement of achievement and changes in affective behavior as a result of being exposed to the IACP instructional system.

5. In depth studies should be conducted pertaining to cognitive and affective performance in other subject areas of education as a result of exposure to the IACP instructional system.

6. Studies should be performed that investigate the relationship between age level of students and achievement concerning exposure to the IACP instructional system.

7. Investigations should be conducted that focus on the relationship between intelligence, aptitude, achievement, and attitudes as a result of exposure to the IACP instructional system.

8. Although this study did not attempt to measure achievement in the psychomotor domain of learning, there is a need to develop strategies and techniques that will assess individual and
group psychomotor achievement performance while enrolled in the IACP program.

Recommendations for the Industrial Arts Education Practitioner

1. If the results of this study are valid, it would appear that the IACP instructional system is a viable alternative to conventional industrial arts education.

2. The World of Construction Achievement Test-Comprehensive Exam appears to be a well devised valid test and therefore is recommended for use in testing situations when the objectives of the test are appropriate.

3. The World of Manufacturing Achievement Test-Comprehensive Exam appears to be an adequate test for measuring the cognitive content of The World of Manufacturing course. It is recommended that the test be used for its intended purpose but that items with low positive and negative discrimination be deleted from the test.

4. The Cooperative General Industrial Arts Test and the General Scale of Attitudes for Junior High School Industrial Arts did not seem to discriminate between the samples for this study. Therefore it is recommended, if the instruments are used, that caution be exercised pertaining to the validity of the test results. It is further recommended that, if the tests are used, modifications be made based on item analysis information and the specified testing objectives before use.

5. If the objectives of any industrial arts instructional sequence are in accord with those of the IACP instructional system
as measured by $T_1$ and $T_2$, it is strongly recommended that the IACP instructional system be adapted. No recommendations are made concerning modifications of the IACP instructional system.

6. It is recommended that both the Construction and Manufacturing courses be institutionalized if the educational objective of the IACP instructional system are deemed worthwhile for the general education of junior high school students.
PLEASE NOTE:


UNIVERSITY MICROFILMS
APPENDIX A

THE WORLD OF CONSTRUCTION ACHIEVEMENT TEST - COMPREHENSIVE EXAM
APPENDIX D

GENERAL SCALE OF ATTITUDES OF JUNIOR HIGH SCHOOL INDUSTRIAL ARTS
APPENDIX E

SAMPLING FRAME
COOPERATING TEACHERS

Mr. Thomas C. Almeida - Long Beach, California
Mr. Bates - Trenton, New Jersey
Mr. Charles Binstadt - Cincinnati, Ohio
Mr. Vern Bonar - Shawnee Mission, Kansas
Mr. Gary Bos - Long Beach, California
Mr. James Cameron - Columbus, Ohio
Mr. Vernon Coleman - Austin, Texas
Mr. Larry Cope - Cincinnati, Ohio
Mr. Harry Crosby - Long Beach, California
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Mr. Lloyd Gober - Austin, Texas
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Mr. Charles Hall - Pontiac, Michigan
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Mr. Robert Starr - Trenton, New Jersey
Mr. Gilbert Steelhammer - Austin, Texas
Mr. Larry Stiggins - Austin, Texas
Mr. E. Perry Suter - Austin, Texas
Mr. Targonski - Trenton, New Jersey
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Mr. Steven A. Walker - Austin, Texas
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Columbus Public Schools  
Columbus, Ohio
APPENDIX F

CLASS DATA SHEET
CLASS DATA SHEET
(To be completed for each class participating in the study)

Teacher's Name ____________________________________________________________

School Name & Address ______________________________________________________

Grade Level of Class (Circle one only)

6  7  8  9  10  11  12

Course Description (Check one only)

_____ IACP Construction

_____ IACP Manufacturing

_____ General Shop

_____ Woods

_____ Metals

_____ Drafting

_____ Other (Please specify) _________________________________________________

The students assigned to this industrial arts class are: (Check one only)

_____ Randomly assigned (Heterogeneous grouping -- a mixture of

_____ Primarily slow learners

_____ Primarily retarded children

_____ Primarily gifted children

_____ Other (Please specify) _________________________________________________

Standardized Group Test of Mental Ability (IQ) used in your school in Grades

6-12

_____ California Test of Mental Maturity

_____ Cooperative School and College Ability Tests

_____ Large-Thorndike Intelligence Tests

_____ Otis Quick-Scoring Mental Ability Test

_____ Science Research Associates Intelligence Test

_____ Other (Please specify) _________________________________________________

Grade Level at which most recent IQ scores were obtained (Circle one only)

4  5  6  7  8  9  10  11  12

Comments ________________________________________________________________
Instructions to Complete Student Information Sheets

1) In the column entitled "Student's Name" list all of the students in the class.

2) In the column marked "Intelligence Quotient" list the latest IQ score for each student as found in his permanent school record. If a student's score is not available, record a (N.A.) in the space.

3) Enter the appropriate number 1 through 7 according to the categories listed below as it applies to the highest level of education achieved by the student's father or guardian (mother, stepfather, uncle, etc.) in the column "Father's Education". If the information is unavailable, record a (N.A.) in the space.

   1. Higher executives of large concerns, proprietors, and major professionals.
   3. Administrative personnel, owners of small business, and minor professionals.
   4. Clerical and sales workers, technicians, and owners of little businesses.
   5. Skilled manual employees.
   7. Unskilled employees.

4) For the column marked "Occupational Status", enter the appropriate letter a through g as it applies to the occupation of the student's father or guardian. If the information is unavailable, record a (N.A.) in the space.

   b. Four-year college graduate (A.B., B.S., B.M.).
   c. 1-3 years college (also business schools).
   d. High school graduate.
   e. 10-11 years of school (part high school).
   f. 7-9 years of school.
   g. Less than 7 years of school.

Note:
In completing the "Student Information Sheets" it might prove profitable and expedient to seek the aid of a guidance counselor or clerical aid to locate the needed data. The students might also help by providing their father's occupation and educational level.

In "example b" on the "Student Information Sheet", N.A. is used for the occupational status of the parent. This would be possible for a child that was orphaned at an early age and lives in an orphanage.
Student Information Sheet
(To be completed for each class participating in the study)

<table>
<thead>
<tr>
<th>Student's Name</th>
<th>Intelligence Quotient</th>
<th>Father's Education (Record Number Only)</th>
<th>Occupational Status (Record Letter Only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example a. John Doe</td>
<td>100</td>
<td>3</td>
<td>c</td>
</tr>
<tr>
<td>Example b. Ted Smith</td>
<td>105</td>
<td>2</td>
<td>N.A.</td>
</tr>
</tbody>
</table>
Bibliography


Cronbach, Lee J. "Course Improvement Through Evaluation." Teachers College Record, LXIV (May, 1963), pp. 672-83.


