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ABSTRACT

The objective of the Industrial Arts Curriculum Project (IACP) was to develop, refine, and institutionalize a new and relevant 2-year junior high industrial arts program. The study focused on "industrial technology," the knowledge of management, production, and personnel practices used by men to produce goods to satisfy their needs through construction and manufacturing activities. As a result of a 6 year program of intensive research and development, field testing, evaluations, and revisions, two 1-year courses were developed. These courses are entitled "The World of Construction" and "The World of Manufacturing." and the instructional packages for each include: textbooks, laboratory manuals, teacher's guides, achievement tests, related hardware, and audio-visual materials. The materials were field tested over a 4-year period with 20,000 students in 13 states and were coordinated through 124 headquarters and field staff. Workshops have been conducted in 45 colleges and universities for preparing teachers to adopt or adapt the IACP system. The instructional packages are available through McKnight and McKnight Publishing Co., Bloomington, Illinois, and are adaptable to existing industrial arts facilities. (Author/GEB)

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Final Report

Project No. 70803
Grant No. OEG-3-7-070003-1608

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ABSTRACT

The objective of the IACP was to develop, refine, and institutionalize a new and relevant two-year junior high industrial arts program. The development efforts focused on the study of "industrial technology," the knowledge of management, production, and personnel practices used by men to produce goods to satisfy their needs through construction and manufacturing activities.

Two one-year courses, "The World of Construction" and "The World of Manufacturing," were developed as total instructional packages including: textbooks, laboratory manuals, teacher's guides, achievement tests, related hardware, and audio-visual materials.

These two courses are the result of six years of intensive research and development, extensive field testing, evaluations, and revisions which utilized the expertise of educators and practitioners from business and industry. Materials were field tested over four years with over twenty-thousand students in 13 states with over 124 headquarters and field staff.

The program has gained the endorsement of educators and industrialists as a relevant educational program that meets the needs of today's youth. Workshops have been conducted in 45 colleges and universities for preparing teachers to adopt or adapt the IACP system. The program is available through a commercial publisher and is adaptable to existing industrial arts facilities.

FINAL REPORT

Project No. 70003
Grant No. OEG-3-7-070003-1608

A JUNIOR HIGH SCHOOL INDUSTRIAL TECHNOLOGY CURRICULUM PROJECT: A Final Evaluation of the Industrial Arts Curriculum Project (IACP), 1965-1971

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
National Center for Educational Research and Development

PREFACE

The final evaluation report of the IACP was a joint effort of numerous educators at the secondary school and university levels. The formal evaluation of the project has been an integral part of the IACP's activities since the first materials on the rationale for and the structure of subject matter were being developed. The project staff sought the professional assistance of many experts from a variety of substantive fields to provide a continuous assessment and feedback of information to help with product development and to lend credibility to the final products.

The major products of the IACP that can be listed include (1) a rationale for and structure of industrial arts subject matter; (2) a system for developing, field testing, disseminating, and evaluating a comprehensive curriculum package system; (3) a two-year instructional package; and (4) inservice and preservice teacher training curricula.

Curriculum evaluation is relatively new in education. The recent emphasis and concern for accountability has caused educators to implement various strategies and techniques to assess the efficacy of curriculum and instruction. A review of the literature in industrial arts education identified a dearth of information relative to the evaluation of industrial arts curricula and curriculum development activities. Indeed, not one comprehensive evaluation effort was identified that could serve as a model. The IACP staff found it necessary, therefore, to develop evaluation strategies, techniques, and practices for a comprehensive evaluation effort. A closed loop system involving a continuous feedback cycle was utilized together with field testing of the instructional program conducted by public school teachers in schools geographically dispersed and with children representing a full range of social, cultural, and educational characteristics.

In addition to the headquarters staff at The Ohio State University who managed the project activities, professional assistance was provided from staff at the University of Illinois, Trenton State College, the University of Iowa, Texas A & M University, and several other leadership institutions. The names of people who have contributed to the ongoing activities of the IACP are listed in this evaluation report, or in the acknowledgment sections of the IACP textbooks. It is recognized that this final official document of the IACP would not read as it does if it were not for the assistance provided by numerous representatives of education, business, labor, and government. Particular recognition must go to the Project Co-Directors, Donald G. Lux and Willis E. Ray, who assumed the role of general managers of the activities and helped the project fulfill its goal of developing and marketing a two-year tested instructional program for industrial arts;

and to A. Dean Hauenstein, Assistant Director, who assumed the primary responsibility for coordinating the development of the curriculum materials.

As in most research projects conducted at universities, a cadre of graduate students provided a major portion of the input to the IACP activities, including the preparation of this final report. Many are now on the faculties of institutions throughout the United States and Canada assuming a continuing leadership role in higher education.

This final evaluation report was prepared to share with the profession the evaluation activities of the IACP. As such, it contains a review of the rationale for the project, a listing of its goals, a discussion of the strategy and practices to attain these goals and, finally, an evaluation and assessment of project outcomes. The preparation of this document was the primary responsibility of the IACP evaluation staff; however, as previously mentioned, it must be considered a project of common authorship.

All project staff members, headquarters and field staff, as well as the thousands of IACP students and their parents, and representatives from business, labor, government, and education have contributed to its development.

Particular recognition must go to my colleagues, Professors Hauenstein, Lux, Ray, and Sredl, and to Field Evaluation Center Directors Jack Ford, J. Russell Kruppa, and Glenn Warrick, who were in Columbus, Ohio, during the summer of 1971 and assisted with the preparation of this document. Also, research associate Larry Miller assisted with the coordination and development of the manuscript.

This document would not be a reality if it were not for the added assistance provided by the families of the staff, who were understanding and supportive of the efforts of their husbands and fathers during the development of the IACP.

Finally, the responsibility for errors or omissions in this document belongs to the undersigned.

James J. Buffer
Assistant Director for Evaluation

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AN OVERVIEW OF THE INDUSTRIAL ARTS CURRICULUM PROJECT (IACP)

The Industrial Arts Curriculum Project (IACP), headquartered at The Ohio State University, was a curriculum development effort undertaken in cooperation with the University of Illinois. The project was administered through The Ohio State University Research Foundation and was supported by the United States Office of Education with contracts and grants totaling over two million dollars. Additional financial support was provided by industrial and business concerns, professional associations, labor unions, and educational institutions.

The major objective of the IACP was to develop, refine, and institutionalize a new and relevant two-year instructional program in industrial arts for junior high school age students. The developmental efforts of the project focused on the study of "industrial technology," the knowledge men use to satisfy their wants for industrially produced goods. Men use this knowledge in two principal activities -- construction and manufacture.

The IACP has developed two courses to provide an understanding of these industrial technologies. The first course for secondary school students is "The World of Construction," and was field tested in the 7th or 8th grade, followed by "The World of Manufacturing" in the 8th or 9th grade. Curriculum materials for both courses include textbooks, laboratory manuals, teacher's guides, achievement tests, and related instructional visuals and hardware.

While engaged in a study of "The World of Construction," students learn how bridges, dams, roads, tunnels, and buildings are produced by a managed-personnel-production system. The importance of management in the construction industry 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, laying floors, and by many other representative activities. Students also design, plan, and build a model house and engage in city and regional planning.

A study of "The World of Manufacturing" is concerned primarily with developing an understanding of how a 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.

These two exciting and relevant industrial arts courses are the result of six years of intensive research, development, field testing, and revision. Substantive elements of the program were principally authored and continuously reviewed by numerous practitioners from industry (including both labor and management) and education. In addition, all curriculum materials were developed and tested by over 40 IACP headquarters staff and 84 field staff in 53 schools in 25 cities in 13 states before the materials were made available commercially. Over 20,000 students covering a complete range of socio-economic and academic ability levels successfully completed the program during field testing.

Each IACP course includes daily terminal performance objectives to guide the teaching-learning process. Ten periodic standardized tests are used, together with observed laboratory performance, to determine achievement of student competencies. Both courses have been developed for classes meeting one class period each day of the school year (about 36 weeks) or the equivalent. The suggested minimum length of each class period is 45 minutes.

Students gain knowledge, attitudes, and skills in management, production, and personnel practices used in industry to create our man-made world. Thus, their liberal education is augmented by their understanding of the man-created environment precisely as the biological and physical sciences contribute to their understanding of the natural world. They also become acquainted with a wide variety of occupations and careers related to construction and manufacturing.

The program may be readily adapted to traditional industrial arts facilities with slight (if any) additional cost. The initial capital outlay for a laboratory built for IACP would be considerably less than for a traditional one, since IACP requires a minimum of expenditures for large power tools, equipment, and furniture. Most construction courses are now taught in former wood shops. Manufacturing, generally, is taught in former metal shops.

The undergraduate curriculum at The Ohio State University was revised to prepare teachers of construction and manufacturing and was begun in Autumn, 1968. Other teacher education institutions have made adjustments in their teacher preparation programs. Summer orientation programs for inservice teacher preparation were conducted by the staff at OSU beginning in 1967 through 1971. IACP teacher preparation workshops were also conducted at 15 other colleges and universities in the summer of 1970, and 45 institutions conducted 72 IACP summer workshops in 1971. To insure the proper introduction of the instructional system, teachers initially received preparation on how to use the materials either at cooperating institutions of higher learning or through participation at inservice workshops taught by experienced IACP teachers in local school systems.

McKnight & McKnight Publishing Company of Bloomington, Illinois 61701, was approved by the U.S. Commissioner of Education as the exclusive publisher and distributor of the Industrial Arts Curriculum Project materials. During a limited copyright period of five years, the royalties are shared equally by the United States Treasury General Fund and the OSU Research Foundation. The latter's share may be used to support dissemination and diffusion activities of IACP such as teacher preparation.

Information and assistance in installing the instructional program may be obtained from the publisher or from the IACP staff at The Ohio State University.

ORGANIZATION OF THE REPORT

Chapter I was written to provide an insight into the need for a contemporary, relevant, interesting secondary school industrial arts program that could bridge the gap between current industrial arts offerings and the technology of modern industry. The description of the Industrial Arts Curriculum Project activities includes a review of: (1) procedures for attaining project objectives, (2) the final products, and (3) the limitations and delimitations placed on the project. Project appropriation and support and the administrative structure of the project are explained in the concluding portion of the chapter.

Chapter II describes the research and developmental efforts of the project. The rationale and conceptualization of the structure of industrial arts subject matter is the emphasis of the first section. This is followed by an explanation of the development of a syllabus for construction and manufacture. The invention of the 1st edition software and hardware package is the topic of the third major section. The developmental revision cycle and a description of the final product are also presented in this chapter.

Chapter III is a description of the evaluation phase for the project. It explains the rationale and formation of an evaluation strategy and its implementation with emphasis on the collection, treatment, and utilization of data for revision of the project program and materials.

Chapter IV contains a review and summary of the evaluation information collected by the IACP headquarters staff and the field evaluation and demonstration center personnel. These data reflect the internal and external assessment of the instructional program and project activities.

Chapter V details the dissemination activities of the project. Brought into focus are three topics. These are: diffusion of information, utilization of demonstration centers, and the contribution of the publisher in meeting the goals of the project.

Chapter VI contains a summary and conclusions, and details some future thrusts that are envisioned by the IACP staff.

The appendices of this report contain several of the products produced through the efforts of the Industrial Arts Curriculum Project. A complete listing of these products can be found in the Table of Contents.

CHAPTER I

ORGANIZATION AND FUNCTION OF IACP

Need for an Innovative Curriculum Project for Industrial Arts Education

Industrial arts education, as a well established and vitally important curriculum area, has recently been affected by the general thrust toward curriculum improvement. Concerned as they are with industrial processes, materials, products, and occupations, industrial arts teachers are increasingly aware of the growing gap between industrial reality and its representation in the total educational program. Moreover, it is evident that many of the traditional approaches used in industrial arts education are incapable of providing students with an adequate understanding of the impact of industry upon our modern man-made world and upon industrial personnel.

A major difficulty plaguing industrial arts education is the fragmented approach for determining instructional content. Students are offered courses based on selected trades or occupations representing only a small part of the complex segment of contemporary society called industry. In these courses, emphasis is placed on the development of specific skills (with some related information) which may or may not reflect current industrial practices. Too often the skills are forgotten as students grow older. They are left with a vague and unrealistic image of industry, a field many will enter upon graduation. The growing number of disillusioned youth, unemployed or underemployed, are evidence of our failure to prepare them to assume their roles as productive citizens in society.

However, in spite of these failures, industrial arts does have the potential for providing youth with the educational experiences and knowledge of the structure, relationships, opportunities, and requirements of industry.

What educators have failed to identify in the past is an organized body of knowledge, a system of concepts and unifying themes applicable to all of industry. It is generally recognized that industrial technology has a basis of solid content, but no one has adequately organized it to be taught in the schools. The successful development of a program to efficiently transmit and extend such a body of knowledge could revolutionize the teaching of industrial arts.

New curriculum designs in other disciplines have been proposed and some developmental programs have been initiated. They have met with varying degrees of acceptance and success. In view of the dynamic and complex character of modern industry, the central question to ask in effecting a major change in industrial arts education pertains to instructional content: What are the appropriate units of instruction? If traditional courses like wood, metal, and drafting are no longer appropriate, what courses or educational experiences <u>are</u> appropriate? Those who have attempted to answer these questions have been confronted by problems which have challenged their limited curricular resources. The obstacles to developing a new program of industrial arts have been:

1. Failure to develop a fundamental structure of the field
2. Absence of textbooks and other instructional materials
3. Lack of appropriate laboratory facilities and equipment
4. Scarcity of research and demonstration projects
5. Outmoded teacher education programs

These obstacles to curriculum improvement called for a comprehensive project which would rigorously define content; develop a package of teaching materials; field test, demonstrate, and disseminate these materials; and organize teacher education programs. Through the procedures subsequently delineated, the Industrial Arts Curriculum Project (IACP) has made a fundamental breakthrough which will provide a new direction on the national scene.

In today's schools, industrial arts teachers have almost total freedom in curriculum planning. Available textbooks and other materials for industrial arts, unlike many subject fields, lend little support to an articulated program. The result is largely a mixture of unrelated fragments of selected trades, together with a random selection of the newer technologies. The materials developed through the IACP are lending system and order to these fragments and are providing important form and configuration.

Perhaps the greatest challenge faced by traditional education is the rapidly changing world of work. It is difficult to predict the future of any narrow occupational category within industry. The educational pattern of the schools must therefore provide programs which will have built-in transfer of learning features which provide the flexibility and adaptability needed for occupational, psychological, social, and economic adjustment.

A properly conceived program of industrial arts at the junior high school level will provide a sound foundation for occupational education at advanced levels. The materials developed by the IACP will enable pupils to organize and systematize their thinking about industry. The structure of industry that was developed during the first phase of the project will provide the means to simplify, analyze, and synthesize the "big ideas" related to "efficient practices" in industry.

The most difficult and unprofitable subject matter to learn is that in which no pattern is recognizable. Through the efforts of the IACP, industrial arts as a curriculum area will have a cohesive, comprehensive, and internally consistent framework from which pupils can draw insights into that complex and productive societal enterprise -- modern industry. The benefits of such insights for enlightened citizenship, educational-occupational guidance, and integration with general culture and the world of work would indeed be substantial.

In summary, there are more than 50,000 industrial arts teachers and more than 4,000,000 pupils currently enrolled in industrial arts programs. Many of these programs need to be reformed if they are to help youth gain knowledge of their modern man-made world and of those who shape it. It might be predicted that greater initial and subsequent change will be achieved through making current programs more effective by: (1) launching a massive effort to remove the block to curriculum improvement, (2) creating and installing an improved program which can be adopted within the present school structure, (3) enhancing adoption probability by demonstrating the validity of the new program using existing teachers and facilities, and (4) having a new program to more clearly indicate the need and direction for an ideal program of the future. In response to these notions, the IACP was conceived.

The Purpose of the IACP

The general purpose of the Industrial Arts Curriculum Project was to effect curriculum change in industrial arts education. To accomplish this, six tasks were undertaken by the project staff. These were:

1. Conceptualization of a structure of the body 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
6. Development of teacher education programs

Objectives and Procedures

For administrative and funding purposes, the project was divided into three major time segments. Phase I of the project covered the period from June 1, 1965 to November 30, 1966.

The objectives of Phase I were:

1. To conceptualize a structure of industry as a basis for content in industrial arts, and

2. To translate this structure into a syllabus which outlines a junior high school program of industrial arts education.

The procedures followed in achieving the above objectives were:

1. The project staff reviewed the literature and developed a morphology of industry, in consultation with experts from industry and supportive disciplines;

2. Task force conferences of experts revised the morphology and derived a taxonomy of the concepts, principles, and unifying themes;

3. The structure was reviewed and evaluated by an opinionnaire study, and by lectures and seminars at selected universities; and

4. Syllabus conferences of experts were conducted in which both valuational and praxiological criteria were applied to the structure in order to develop a syllabus for a junior high school industrial arts program.

The second phase of the project covered the period from December 1, 1966 through June 30, 1969.

The major objectives of Phase II were:

1. To design an effective two-year articulated program of study for industrial arts in grades 7, 8, and 9;

2. To develop teaching materials which can be used successfully in existing schools, with representative industrial arts teachers, and with pupils of all ability levels; and

3. To install and evaluate the effectiveness of the program and materials in three field centers and twelve schools in FY '68, and six field centers and twenty-four schools in FY '69.

The procedures followed in achieving the above objectives were:

1. Development of a two-year sequence of course materials which include, for each year, a textbook, student laboratory manual, teacher's guide, achievement tests, laboratory equipment, and other teaching aids;

2. Establishment of Field Evaluation Centers through which the above curriculum materials could be tested and evaluated;

3. Collection of evidence from the field trials so that the materials as developed and revised can be used successfully in existing schools, with representative industrial arts teachers, and with pupils of all ability levels; and

4. Preparation of cooperating field center teachers through orientation and inservice programs to successfully adapt to the new course content, materials, and procedures.

The third and final phase of the project was from July 1, 1969 through August 31, 1971.

The major objectives of Phase III were:

1. To complete the partially completed developmental cycle of a two-year articulated program of industrial technology for the junior high school, and

2. To design and implement a dissemination program that will insure maximum impact on school practice.

The procedures to achieve the above objectives were:

1. To continue to field test and revise the teaching-learning materials and instructional system that were partially developed in FY '68 and FY '69 ("The World of Construction" through FY '70 and "The World of Manufacturing" through FY '71);

2. To continue to evaluate the effectiveness of the materials and instructional system in six field centers and twenty-four schools in FY '70 and FY '71; and

3. To establish a dissemination program that will extend program viability through demonstration centers and provide for the optimum distribution and use of materials.

By following the above procedures and accomplishing the objectives, the IACP has been successful in effecting desirable curriculum change in industrial arts, a change from the fragmented and amorphous activities of present-day industrial arts to an articulated program of study based on a structured body of knowledge and on meaningful patterns of experience. As a result, students now have an opportunity to develop an understanding of their man-made world and to enjoy the benefits of their insights and knowledge in enlightened citizenship, educational-occupational guidance, and personal integration with their technological culture and the world of work.

The Products

The major accomplishment of the project was an instructional system based on a logically derived rationale and body of knowledge that was field tested, revised, and disseminated to qualified industrial arts teachers for adoption, or adaptation, throughout the United States. The two-year sequence of "The World of Construction" and "The World of Manufacturing," together with related professional programs, e.g., teacher preparation, were the result of this research, development, evaluation, and dissemination effort. The entire program is thought to have the potential for improving the junior high school industrial arts curriculum by providing relevant and exciting learning experiences of the man-made world much as science provides knowledge of the natural world.

Limitations and Delimitations

The major constraints placed on the Industrial Arts Curriculum Project's activities were the financial base totaling approximately $2 million and the available manpower and time to attain project goals. Related to these factors was the limited knowledge base available from which to make decisions concerning many of the facets of the innovative curriculum endeavor since, clearly, this was the first major attempt to plan, organize, and control a massive curriculum development effort in industrial arts. Therefore, throughout the duration of the IACP, several delimitations were established as guidelines for project activities. These included:

1. A rationale and structure for the derivation of subject matter for industrial arts would be developed.

2. The rationale would be used as a referent to structure a discipline approach to curriculum development; that is, the IACP instructional program would be based on a logically derived body of knowledge.

3. The first attempt at curriculum development would begin with the junior high school program, since it is at this level where the greatest number of children study industrial arts on a required basis.

4. The developmental efforts focused on the preparation of a two-year instructional sequence.

5. The program could be effectively and efficiently implemented in the junior high school curriculum.

6. The final product would be monetarily competitive with other available programs in industrial arts.

7. The project was to be completed during a six-year period.

Appropriations and Support

As indicated, the general purpose of the Industrial Arts Curriculum Project was to effect curriculum change in industrial arts education. This grew out of a request by the Cincinnati Public Schools to the Industrial Technology Education Faculty at Ohio State to stop "talking" about ideal educational programs and to develop a better educational curriculum for industrial arts education. An outcome of this request was a funding proposal submitted by The Ohio State University and the University of Illinois to the United States Office of Education. This initial input ultimately led to the creation of the Industrial Arts

Curriculum Project which is also known by its acronym, IACP.

Because of the magnitude and complexity of the project's undertaking, the initial request for funding from the United States Office of Education focused only on developing a rationale and structure of industrial arts subject matter and an accompanying syllabus for a junior high school program. This proposal was approved in theory and negotiated in two parts over an 18-month period. The contract was funded as follows:

- June 1, 1965 through June 30, 1966 for the amount of $126,420
- July 1, 1966 through November 30, 1966 for the amount of $111,130

On July 1, 1966, a proposal was transmitted in the amount of $4,160,190 covering a 57-month period from December 1, 1966 through August 31, 1971. While the USOE accepted this proposal in theory, it was requested that the proposal be revised to cover a smaller time-span with an expenditure of about $1 million. On September 23, 1966, a revision was transmitted to the United States Office of Education covering a 31-month period from December 1, 1966 through June 30, 1969. This document listed three major objectives: program design, teaching materials development, and initial pilot testing. It should be pointed out that this was an interim proposal not intended to provide a completed product comparable to the outcome proposed in the original four million dollar proposal. This proposal was approved and negotiated in three parts as follows:

- December 1, 1966 through June 30, 1967 for the amount of $169,020
- July 1, 1967 through June 30, 1968 for the amount of $349,970
- July 1, 1968 through June 30, 1969 for the amount of $500,000.

On February 14, 1969, a project extension was submitted to USOE and was approved for a 26-month period from July 1, 1969 through August 31, 1971. Emphasis during this period was placed on completion of the developmental cycle and dissemination of the IACP program. Funding during the project extension was divided into five periods. These were:

- July 1, 1969 through May 31, 1970 for the amount of $250,000
- June 1, 1970 through June 30, 1970 for the amount of $90,000
- July 1, 1970 through September 30, 1970 for the amount of $128,938
- October 1, 1970 through May 30, 1971 for the amount of $205,000

- May 31, 1971 through August 31, 1971 for the amount of $136,483

At the termination of the project, August 31, 1971, the total appropriations through USOE support exceeded $2 million. Of this amount, approximately one-fourth was expended in the direct operation of the field centers. Table 1 sets forth an overview of the field center direct expenditures by year.

In addition to the financial support by the United States Office of Education, several interested publics aided the project's efforts. A number of industrial and professional organizations provided the following:

1. The Ohio Joint Industry Council of Contractors and Building Trades Unions contributed $15,000 to provide the services of an audio-visual consultant.

2. The International Brotherhood of Electrical Workers contributed $15,000 to the development of audio-visual materials.

3. The American Society of Civil Engineers provided, at their full expense, a resident consultant for six weeks to assist in the substantive review of "The World of Construction."

4. The Associated General Contractors of America and the American Institute of Architects appointed educational committees specifically to contribute time to the substantive review of materials.

5. The officers and staff of the Society of Manufacturing Engineers, the Ohio Manufacturers' Association, and the National Association of Manufacturers contributed time for identifying consultants, for writing materials, and for substantive reviews.

6. Each of the AFL-CIO Building Trades International Unions of the Bricklayers, Carpenters, Electrical Workers, and Sheet Metal Workers sponsored and funded thirty-minute colored motion picture films to project specifications.

7. The Ohio Bureau of Employment Services contributed, at no cost, four writers and reviewers who contributed substantially to the authenticity of the occupational information in the courses.

FIELD CENTER DIRECT EXPENDITURES

	FY-68	FY-69	FY-70	FY-71	TOTALS
Field Center Personnel	$10,200 (15)	$34,800 (54)	$40,200 (54)	$23,400 (30)	$108,600
Field Center Operation	2,000	7,500	7,500	3,000	20,000
Printing	30,000	65,000	65,000	32,000	192,000
Hardware	6,000	15,000	15,000	10,000	46,000
Shipping	1,200	3,000	3,000	2,000	9,200
Conferences*	24,000	64,500	51,000	36,000	175,500
				Total Direct -	$551,300

* Mid - year and summer evaluation and revision conferences.

TABLE 1

8. The International Brotherhood of Electrical Workers and the National Electrical Contractors Association jointly contributed $40,000 in scholarships to support the preparation of teachers of construction technology.

9. The Society of Manufacturing Engineers contributed $25,000 to pay half the total cost for printing student texts and laboratory manuals for 1969-70 because the cutback in USOE funds would not cover that cost. This donation prevented closing half of the field testing program that school year.

Most of the organizations and groups listed above have officially endorsed the work of the project. These are only representative examples of the growing volunteer, private support that has been obtained to date.

Support for the project and the IACP-developed instructional system was overwhelming on the part of the participating school systems. Support was based upon the careful, thorough, and complete cycle of development, field testing, and revision of the materials for each year during a three-year period for each course. Teachers, local supervisors, principals, and other administrators in each field evaluation and demonstration center were unanimous in their support of IACP activities. The intense interest and motivation shown by the pupils involved were heartening. Parental and lay support for these new programs were also substantial.

The Administrative Structure

The IACP, although a combined effort of the Colleges of Education of The Ohio State University and the University of Illinois, was officially administered by The Ohio State University Research Foundation. The project was conducted primarily by staff at The Ohio State University; however, interwoven into the organizational structure was the commitment and involvement of the administration, selected faculty members, and services provided by numerous educational institutions and systems. Thus, the IACP was a cooperative effort to find a solution to a major problem.

Headquarters Staff

The project was headed by Edward R. Towers from its inception in 1966 through June 30, 1969. Donald G. Lux and Willis E. Ray served as the associate directors during that period. An administration change was made in 1969 to allow Towers to pursue interests outside of the university community. Due to the significant need for a contemporary and relevant industrial arts curriculum in the secondary schools of the nation, and the tremendous support IACP had received by business, industry, education, and community sources, the IACP National Advisory Committee strongly urged that the Industrial Arts Curriculum Project be continued. On February 14, 1969, a proposal for extension of the IACP was submitted to the USOE under the co-directorship of Professors Lux and Ray. The proposed continuation and extension of the IACP curriculum development activities were approved through August 31, 1971.

The IACP administrative staff included:

Co-Directors:	Dr. Donald G. Lux Dr. Willis E. Ray
Associate Directors:	Dr. James J. Buffer, Evaluation Dr. A. Dean Hauenstein, Curriculum Development Dr. Henry J. Sredl, University of Illinois Division

Professors Lux and Ray assumed the leadership for managing the general operation of the project. In order to divide project responsibility, Lux was primarily responsible for the development of "The World of Construction" and Ray for "The World of Manufacturing." Professor Buffer was responsible for the evaluation of the project and its related activities, and Professor Hauenstein coordinated the development of the curriculum materials. Professor Sredl was a director of the Chicago-Evanston Field Evaluation Center and also served as the project liaison at the University of Illinois. A fair assessment of the project activities during the past few years would suggest that the management efforts of the project were truly a team effort. Each member of the project administrative staff provided assistance in a wide variety of professional endeavors to help make the IACP instructional system a reality.

An organizational chart showing the administrative organization and the relationship of the personnel involved with the IACP program is presented in Figure 1.

I A C P
ADMINISTRATIVE ORGANIZATION

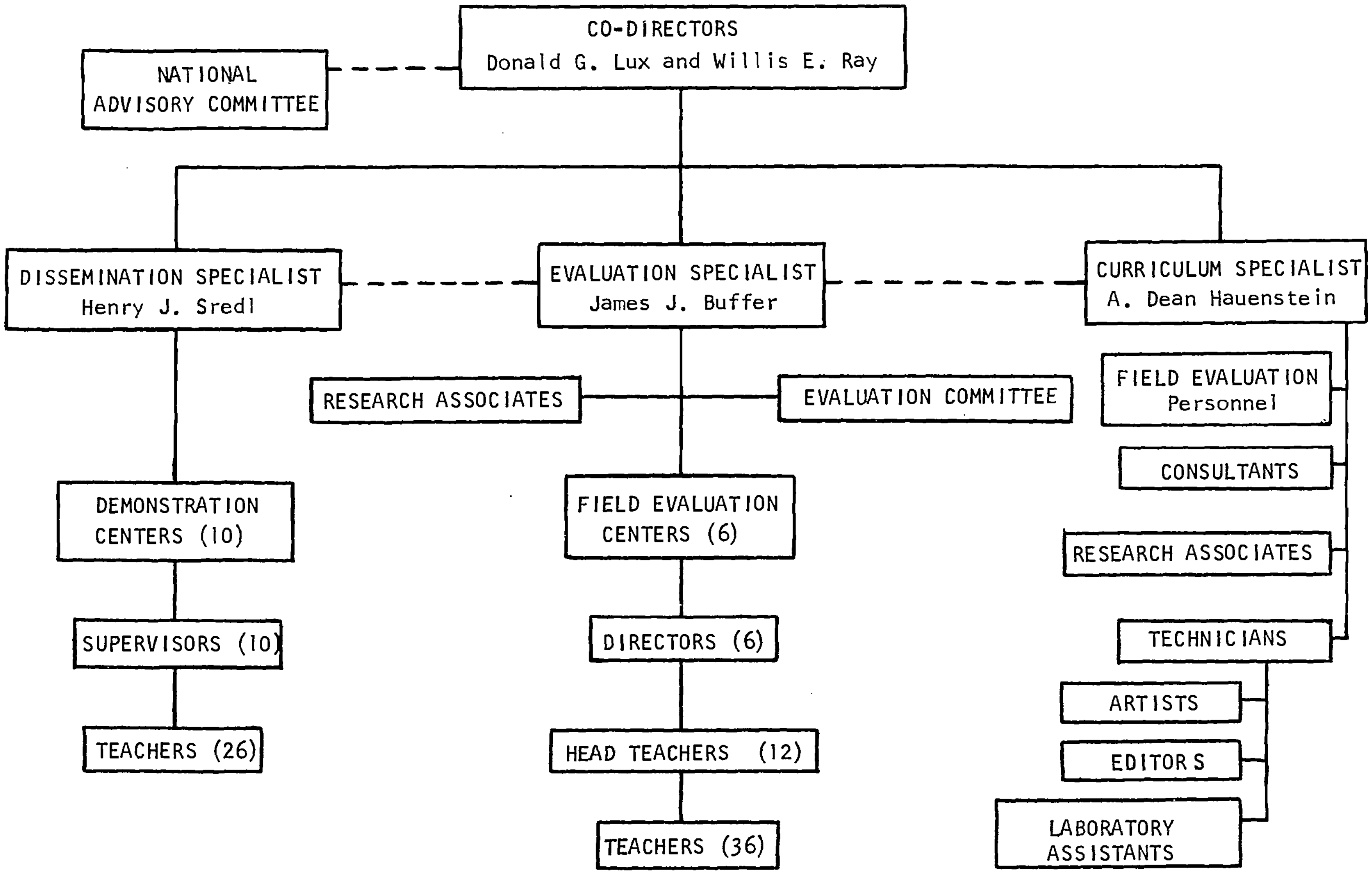


FIGURE 1

Resumes of Headquarters Staff

Brief resumes of the administrative personnel at The Ohio State University and the University of Illinois are included to provide representative professional achievements of the headquarters staff.

Co-Director. Donald G. Lux, Ph.D., The Ohio State University, 1955. Teacher of industrial arts and vocational-industrial education, Louisville, Kentucky, 1949-1952; Instructor, The Ohio State University, 1952-1954; Assistant Professor, Industrial Education, University of Illinois, 1954-1957; Associate Professor, Industrial Education, University of Illinois, 1957-1959; Assistant Dean, College of Education, University of Illinois, 1959-1961; Associate Professor and Chairman, Industrial Education, University of Illinois, 1961-1962; Consultant to National Council of Educational Research and Training of the Government of India, 1962-1964; Associate Professor, Vocational and Technical Education, and Chairman, Industrial Education Division, University of Illinois, 1964-1965; Professor of Education and Associate Director of the Industrial Arts Curriculum Project, The Ohio State University, 1965-68, Co-Director, 1969-71; Elected Vice President and National Program Chairman, American Council on Industrial Arts Teacher Education, 1961-1963. Elected President, ACIATE, 1970-72; Vice President, American Industrial Arts Association, 1970-72; Editor, ACIATE Yearbook XI, Essentials of Pre-Service Preparation, 1962. Co-Author of ACIATE Yearbook X and of two textbooks. Contributor to: AV Journal, Journal of Teacher Education, Comparative Education Review, The Industrial Arts Teacher, Industrial Arts and Vocational Education, Civil Engineering, Theory Into Practice, and School Shop. Educational Consultant, O'Neil-Irwin Manufacturing Company, 1951-1962.

Co-Director. Willis E. Ray, Ed.D., University of Illinois, 1957. Research Assistant in Industrial Education, University of Illinois, 1951-1952; Teacher of industrial arts, Bloomington, Illinois, 1952-1954; Teacher of industrial arts (Instructor in Education), University High School, Urbana, Illinois, 1954-1957; Assistant Principal, University High School, Urbana, Illinois, 1955-1957; Assistant Professor of Education, The Ohio State University, 1957-1960; Associate Professor of Education, The Ohio State University, 1960-1964; Consultant to the Ministry of Education, Government of India, 1962-1964; Professor of Education, The Ohio State University, 1964- ; Associate Director of the Industrial Arts Curriculum Project, 1965-68, Co-Director, 1969-71; Chairman, Research Committee, American Industrial Arts Association, 1959-1961; Member, Research Committee, American Vocational Association, representing Industrial Arts Division, 1959-1961; Director, NDEA Institute for Advanced Study in Industrial Arts, 1967; Secretary, ACIATE, 1968-70; Assistant Editor for Industrial Arts, Journal of Industrial Teacher Education, 1964-1966; Educational Evaluation Consultant, Industrial Arts, American Peoples Encyclopedia, 20 volumes, 1955 edition; Co-authored research bulletin, The Status of Industrial Arts in the Public Secondary Schools of Ohio, 1959; Member of writing and editorial committees for curriculum bulletin, A Guide for Industrial Arts in Ohio Schools, 1960; Contributor of 20 articles to professional journals, 1954-1971; Co-Author of ACIATE 19th Yearbook; Co-Editor, ACIATE 20th Yearbook; President-Elect, Ohio Industrial Arts Association, 1970-72; Member, Ohio Advisory Council for Vocational Education, 1971-73.

Assistant Director, Project Evaluation. James J. Buffer, Ed.D., University of Illinois, 1966. Industrial arts teacher, teacher of the mentally handicapped, guidance counselor, and administrator, Chicago Public Schools, 1958-1963; Teaching Assistant, University of Illinois, 1963-1964; Assistant Professor of Industrial Education, Chicago State College, 1964-1967; Assistant Professor of Education, and Dissemination and Test Development Specialist for the Industrial Arts Curriculum Project, The Ohio State University, 1967-69; Associate Professor of Education and Assistant Director of IACP, The Ohio State University, 1969- ; Educational Consultant, National Home Study Council (Washington, D.C.); author of numerous journal articles in industrial arts, counseling, and special education; prepared four textbooks and study guides in technical subjects; contributing author and editor of project instructional materials; Co-Author of ACIATE, 20th Yearbook, Components of Teacher Education; Editor and contributing author of: The Industrial Arts Supplement to the Consumer Education Curriculum Guide for Ohio, 1971; and A Guide for Industrial Arts Teachers of the Educable Mentally Retarded.

Assistant Director, Curriculum Development. A. Dean Hauenstein, Ph.D., The Ohio State University, 1966. Teaching and Research Associate, The Ohio State University, 1964-1966; Instructor of Industrial Arts, Miami University, Oxford, Ohio, 1961-1964; Teacher of Industrial Arts, Dayton Public Schools, Ohio, 1957-61; M.Ed., Miami University, Oxford, Ohio, 1959; Teacher of Industrial Arts, Union County School System, Ohio, 1957; B.S., Miami University, Oxford, Ohio, 1952. Curriculum Materials Specialist, for IACP, 1966-69; Assistant Director, Curriculum Development, 1969-71, for IACP, The Ohio State University, Adjunct Associate Professor, 1969-71, The Ohio State University; over 30 presentations on IACP across the nation to school systems; State and National, Industrial Arts conferences, and industrial organizations; contributing author and editor of project instructional materials; Author of book: Curriculum Planning for Behavioral Development, 1972; Author of articles, "A Study of the Man-Made World for Elementary Schools," 1969 in Where the Action Is; "Developing IACP Teaching-Learning Experiences and Materials," in New Concepts in Industrial Arts, 1968; numerous brochures; Consultant to various educational institutions, 1966-71.

Assistant Director, University of Illinois Division. Henry J. Sredl, Ph.D., The Ohio State University, 1964. Associate Professor, Vocational and Technical Education, and Field Evaluation Center Director, University of Illinois, 1967- ; Supervisor, Industrial Education, Cincinnati Public Schools, 1965-67 (Dr. Sredl worked to establish the Cincinnati Public Schools as one of the first project field evaluation centers.), Assistant Professor, Montclair State College, New Jersey, 1963-65; Instructor, The Ohio State University, 1961-63; Instructor, Montclair State College, 1960-61; Industrial Arts Instructor, New York City Public Schools, 1958-60; Director of Illinois RCU-funded project, "The Use of Portable Video Tape Recorders and Microteaching Techniques to Improve Instruction in Vocational-Technical Programs in Illinois -- Phase II," 1968; Author of numerous professional articles; Consultant.

The resumes for other staff members who were formerly associated with the IACP project are included below.

Past Project Director. Edward R. Towers, Ph.D., The Ohio State University, 1955; Industrial arts teacher, Benton, Illinois, 1949-51; Supervisor of Industrial Education and Diversified Occupations Coordinator, Benton, Illinois, 1951-53; Instructor, The Ohio State University, 1953-55; Assistant Professor of Education, The Ohio State University, 1955-1959; Associate Professor of Education, The Ohio State University, 1960-1966; Professor of Education, The Ohio State University, 1966-69; Coordinator, Industrial Arts, The Ohio State University, 1965-69; Chief of Party and Vocational Education Adviser to the Government of India, Ministry of Education, 1960-62; Chairman, International Relations Committee, American Industrial Arts Association, 1963-64; Co-author of one textbook, 9 articles, 2 research studies, 32 school surveys, and editor of 3 texts. Consultant to numerous schools and business concerns.

Past Evaluation Specialist. Robert E. Blum; B.A., Colorado State College, Greeley; Junior high industrial arts teacher, three years, Arvada Junior High, Jefferson County, Colorado; Ed.D., Texas A&M University, College Station; Assistant Professor of Industrial Arts, one year, California State College at Long Beach, Long Beach; Assistant Professor of Education, The Ohio State University, Columbus, 1966-69; Past Evaluation Specialist for the IACP, 1967-69.

Past Dissemination Specialist. John D. Jenkins, Ed.D., Texas A&M University, 1969. Industrial arts teacher, Harvey, Illinois, 1959-1963; Instructor, Ohio University, 1963-1965; Assistant Professor of Industrial Technology, Ohio University, 1966-67; Assistant Professor of Education, The Ohio State University, 1967-70; NDEA Fellow, Texas A&M University, 1965-1966; Consultant to Tipp City Public Schools, 1967; has contributed editorial services to the IACP; IACP dissemination specialist, 1969-70.

Past Representative from the University of Illinois Division. Jacob Stern, Ph.D., Wayne State University, 1964; Seven years of industrial experience as journeyman tool and die maker; Teacher of Related Shop Theory, Henry Ford Community College, Detroit, Michigan, 1956-59; Teacher of Industrial Arts, Oak Park High School, Oak Park, Michigan, 1959-60; Instructor, Wayne State University, 1960-62; Assistant Professor, University of Illinois, 1962-66; Associate Professor, Michigan State University, 1966-68; Associate Professor of Vocational-Technical Education, University of Illinois, 1968- ; Principal Investigator, "An Investigation of the Auditory Environment of Machine Shop Teachers," Bureau of Educational Research, University of Illinois, 1963-64; Associate Investigator, "A Taxonomy of Educational Objectives: Psychomotor Domain," Bureau of Educational Research, University of Illinois, 1964-65; Author or Co-author of several journal articles; Assistant Editor for Trade and Industrial Education, Journal of Industrial Teacher Education, 1964-66; Representative to the American Vocational Association Advisory Council on behalf of the National Association of Industrial Teacher Educators, 1963-69.

National Advisory Committee

A group of leaders from education, business, industry, and labor served as members of the IACP National Advisory Committee to provide guidance and direction regarding policy affecting the project's activities. The members of this committee are listed below:

Dr. Max Beberman, Director (Deceased)
UICSM Mathematics Project
University of Illinois
Urbana, Illinois

Dr. Rupert N. Evans (Chairman)
Professor of Vocational and
Technical Education
University of Illinois
Urbana, Illinois

Mr. John E. Harmon
Executive Vice President
National Employment Association
Washington, D.C.

Mr. Daniel MacMaster, President
Museum of Science and Industry
Chicago, Illinois

Mr. M. A. Maurer, President
National Screw and Manufacturing Co.
Mentor, Ohio

Mr. C. I. Mehl, Executive Director
Philadelphia Builders' Chapter
The Associated General Contractors
of America
Philadelphia, PennysIvania

Dr. M. Eugene Merchant
Director of Research Planning
Cincinnati Milicron Inc.
Cincinnati, Ohio

Mr. Nicholas J. Radell
Vice President
Cresap, McCormick, and
Paget, Inc.
Management Consultants
Chicago, Illinois

Mr. Bernard M. Sallot
Assistant General Manager
Technical Divisions
Society of Manufacturing
Engineers
Dearborn, Michigan

Dr. Jerome M. Shostak
Educational Specialist
Western Electric Fund
New York, N.Y.

Mr. William Sidell
First General Vice President
United Brotherhood of Carpenters and Joiners of America
Washington, D. C.

Mr. Charles W. Staab
Former Executive Vice President and
Business Manager
Cincinnati Enquirer
Cincinnati, Ohio

The Advisory Committee conducted formal meetings to consider project problems and strategy at the following times and places:

October 7-8, 1965 at Green Meadows Country Inn north of Columbus, Ohio
March 17-18, 1966 at the NEA Building, Washington, D.C.

September 8-9, 1966 at Hotel Ambassador in Washington, D.C.
March 6-7, 1969 at the Barkley House at the Greater Cincinnati Airport
December 1-2, 1969 at the Imperial House in Arlington, Columbus, Ohio
October 28-30, 1970 at The Camelback Inn in Phoenix, Arizona
September 23-24, 1971 (Final Meeting) at The Museum of Science and Industry in Chicago, Illinois

Evaluation Advisory Committee

Three nationally known educators agreed to function as advisors for the final evaluation of the Industrial Arts Curriculum Project. They were:

Dr. Walter J. Foley, Director
Iowa Educational Information Center
University of Iowa
Iowa City, Iowa

Dr. J. Thomas Hastings, Director
Center for Instructional Research & Curriculum Evaluation
University of Illinois
Urbana, Illinois

Dr. Daniel L. Stufflebeam, Director
Evaluation Center
The Ohio State University
Columbus, Ohio

A discussion of the role of the Evaluation Advisory Committee along with other personnel who also contributed to the evaluation of the project is included in Chapter III.

Additional Project Staff (1967-71)

An additional fifty graduate students were employed as research associates assisting with the development and evaluation of the IACP instructional materials. Of the fifty, twenty-two have been awarded the doctorate in industrial arts education. The average age of the research associates who completed the Ph.D. was 32.5 years and represented 16 states. All research associates had completed from one to eleven years of teaching experience before initiating their doctoral studies, some at the college level. Approximately three-fourths of the research associates wrote dissertations relating to the Industrial Arts Curriculum Project. Representative topics included (1) clarifying the need for both psychomotor activities and cognition in learning praxiological concepts, (2) development and use of a comprehensive test for construction technology, and (3) the comparison of psychomotor and cognitive achievement of students enrolled in IACP and conventional industrial arts programs. Abstracts of these studies are included in the Appendix.

A complete list of these men can be found in the acknowledgement sections of the construction and manufacturing textbooks together with a list of over one-hundred consultants who served as writers and reviewers of the instructional material.

The field evaluation of the instructional program was an integral part of the product development. It was necessary to select local school systems in various geographical sections of the country and through them recruit industrial arts teachers willing to teach the IACP program as members of the field test center evaluation team. The six regional evaluation centers and their directors were as follows:

IACP Field Evaluation Centers	Directors
California — Long Beach	Dr. Glenn D. Warrick
Florida — Dade County	Mr. James Morris
Illinois — Chicago-Evanston	Dr. Henry J. Sredl
New Jersey — Trenton-Hamilton-New Brunswick	Dr. J. Russell Kruppa
Ohio — Cincinnati	Mr. Jack D. Ford
Texas — Austin	Dr. Donald L. Clark

A complete listing of the fifty teachers and the six directors who coordinated evaluation activities in the regional Evaluation Centers is also listed in the textbooks. A description of their roles and responsibilities in the project is included in Chapter III of this report.

Additional headquarters staff included four experienced editors of educational material, three professional artists and designers, a secretarial staff, and numerous undergraduate industrial arts students who produced educational hardware and teaching aids and prepared materials for shipment to Field Evaluation Centers.

Summary

The IACP evolved from the need to provide more relevant educational experiences regarding technological practices used by man to provide for his material needs and desires. The project was headquartered at The Ohio State University, funded by the USOE, and administered by the OSU Research Foundation. Staff from the University of Illinois and numerous public school systems assisted with the research, development, evaluation, and dissemination of the instructional system. Representatives from business, industry, and substantive specialists from the academic community also provided professional assistance.

The following chapters describe the strategy, techniques, and practices used by project staff to develop, field test, evaluate, revise and disseminate the two instructional programs, "The World of Construction" and "The World of Manufacturing." The project staff has prepared this report to share its experiences with the profession in hopes of improving man's accumulated knowledge and efficient actions.

CHAPTER II

RESEARCH AND DEVELOPMENT

The first phase of the project focused on the conceptualization of a structure of industrial arts subject matter. This was necessary because of the relatively large gap between theory and practice in industrial arts and the resulting confusion regarding the character and boundaries of content.

Research Methods

Recent efforts on the application of PERT (an acronym for Program Evaluation and Review Technique) have indicated that this technique results in more detailed planning and effective administration and control of educational research. Therefore, PERT was used in planning the first phase of this project. It was found that approximately 18 months would be required to complete the first phase of the total project which included (1) conceptualization of a structure, and (2) development of a syllabus. A descriptive procedure for these two parts of Phase I follows.

Conceptualization of the Structure

In order to derive a structure of the content of industrial arts, the project staff first made a comprehensive literature analysis and produced an annotated bibliography. A review was made of as many different categorization systems of industry as possible, e.g., the Standard Industrial Classification Manual, the Dictionary of Occupational Titles, and the Census of Manufactures. These and similar systems were studied for common elements and differences of categorization and classification.

During this review, the project staff began developing a set of criteria for determining a structure. These criteria involved scope, limitations, and sequence. Upon completion of the literature analysis and the development of criteria, the project staff developed a working paper on the structure of content with examples of fundamental concepts and principles.

Throughout the development of the paper, consultants were employed to assist the staff. These consultants were selected from the following fields to provide an interdisciplinary approach to the conceptualization of the structure: philosophy, sociology, psychology, economics, physical science, engineering, industrial management, and labor.

After being considered by the Advisory Committee at its first meeting, the working paper on structure was distributed to members of an initial Task Force. This Task Force considered the suggested draft structure and made appropriate modifications. Following this, a series of Task Force groups further identified the concepts and principles within each major division of the structure. A final Task Force conference was held to review the overall structure, the divisions within the structure, and the concepts and principles contained therein.

The Task Force members were selected after consultation with the Advisory Committee. The personnel of the Task Force groups were drawn from such substantive areas of industry as industrial design, industrial engineering, civil engineering, mechanical engineering, electrical engineering, aeronautical engineering, metallurgical engineering, industrial psychology, labor economics, and industrial organization and management.

The project staff next prepared a revised draft of the paper entitled, "A Rationale and Structure for Industrial Arts Subject Matter." This draft, together with a detailed opinionnaire, was sent to approximately 100 leaders in education, e.g., state and local supervisors, school administrators, teacher educators, and selected teachers. The reactions of this peer group were presented at the second meeting of the Advisory Committee.

After making the recommended revisions, the paper was duplicated and distributed. Dissemination lectures were held at selected colleges and universities. Written audience evaluation forms were obtained at the close of each lecture. Feedback from these lectures and evaluation sessions assisted the project staff in assessing the acceptability of the rationale and structure, and in planning the syllabus conferences.

Development of the Syllabus

The next step, after having developed a structure within which the major concepts had been placed in taxonomical order, was the development of a syllabus for the junior high school. In order to complete this task, it was necessary to first identify the criteria for selecting and organizing learning experiences from a structured body of knowledge. Six factors were identified which were to provide guidelines for the selection and organization of learning experiences. These six factors were: (1) The Structure of the Body of Knowledge, (2) Desired Behavioral Change or Objectives of Instruction, (3) The Nature of the Learner, (4) School Facilities and Materials, (5) Instructional Procedures and Materials, and (6) Measurement and Evaluation.

Following this development, the next task was to identify the criteria for developing curriculum materials. A conference group was then organized to develop daily objectives to the first year's course - - construction. Using the criteria and the daily objectives, a teaching program was developed for a first-year course in industrial arts at the junior high school level. This program, entitled Industrial Technology I, The World of Construction, was completed, reviewed by the Advisory Committee, and, where necessary, modified.

The next step in the development of the syllabus consisted of a series of conferences resulting in a detailed outline of the reading assignments. Throughout the process of detailing this outline, numerous consultants were used from the substantive areas of construction and educational methodology.

Research Results

The major product of the first 18-month segment of the IACP was the formulation and refinement of "A Rationale and Structure for Industrial Arts Subject Matter" by Edward R. Towers, Donald G. Lux, and Willis E. Ray.

The Generalized Model of Industrial Technology presented in this volume must not be construed as the ultimate or definitive structure for the body of knowledge from which industrial arts subject matter is to be selected. After thorough and extensive research, it represented the most advanced and most promising conceptual construct that the project staff was able to conceive. Its tentative quality was openly admitted, as all conceptual schemes are subject to review, refinement, and modification.

The Development Phase

The purpose of this section is to explain (1) the development of the curriculum materials and instructional system, (2) the design of the package, (3) the construction procedures of the program components, and (4) the continuing development and production of the project materials. Included in this section are some of the criteria and constraints which influenced the development of the total program package.

The Research Phase produced a rationale for industrial technology and a structured body of concepts representative of management, production, and personnel technologies. The first task of the development was to invent a schema for transposing this body of knowledge into an instructional form for use in grades 7, 8, or 9.

Criteria and Constraints

The following are criteria and constraints which had to be established and/or investigated. These factors, therefore, determined the parameters of the design solution of the invention.

1. Basic technological concepts would be expanded via a textbook.

2. A workbook would reinforce these concepts.

3. A laboratory manual would be provided for laboratory work which would further reinforce these concepts.

4. A teacher's guide would provide the teacher with basic information for implementing the course.

5. There would be periodic achievement tests.

6. Essential hardware and instructional aids would be provided.

7. Construction should probably be taught in the traditional woodshop and manufacturing should be taught in the traditional metalshop.

8. Each course would be of one school year in duration.

9. Each course would be designed around one 45-minute instructional period per day, five days per week.

10. There would be behavioral objectives for every day of instruction.

11. Activities would be representative of each major technological concept.

12. Program costs should be commensurate with present junior high school industrial arts budgets.

13. Activities should have "student appeal" and interest.

Preliminary Pilot Study

In September, 1965, the first effort was undertaken to determine the processes and problems of developing curriculum materials from a selected concept. The procedures and problems of generating a text, workbook, laboratory manual, teacher's guide, achievement tests, and instructional hardware had to be discovered. Included in the procedures was the setting up of a teaching center to test and evaluate both the instructional materials and the developmental procedures.

The concept "Interchangeability of Parts" was selected as a test case to encompass three instructional periods. A research assistant was assigned the task to generate the materials and initially teach the materials in the Cincinnati Public Schools. The supervisor of industrial arts for the Cincinnati Junior High Schools was to establish a test center in the schools.

The concept was researched and a text was written. A professor of industrial engineering at The Ohio State University reviewed and approved the text materials. Activities to expand the meaning and application of the concept were created. The activity procedures were written and the necessary instructional hardware was designed. The teacher's guide was written and achievement tests were developed. Photographs were taken in a local industry for inclusion in the materials. Artwork was generated and hardware was constructed. The materials were typed, edited, revised, and photocopy made ready and printed. The software and hardware were taken to Cincinnati and the materials were taught by a project staff member over a three-day period. An evaluation was made of the entire process. The materials were then revised and taught again by eight classroom teachers. Problems were identified and suggestions were made for alleviating the classroom problems. Insight was gained in the problems and procedures for generating instructional materials and establishing test centers. Estimates were made as to costs, time requirements, personnel requirements, materials, and procedures for developing and implementing an innovative program.

Scheduling with PERT

Based on the preliminary pilot study, projections were made for the work to be accomplished from December 1, 1966 to August 31, 1971. A PERT chart was generated which scheduled activities over the 57-month period. Included were detailed schedules for the development-test-revision cycle of textbooks, workbooks, laboratory manuals, teacher's guides, achievement tests, films, transparencies, slides, filmstrips, charts, and hardware, e.g., jigs, fixtures, and special apparatus. Thus plans, schedules, and deadlines were established for the development, testing, and revision of construction and manufacturing materials as shown in an abbreviated form in Figure 2.

Design of the Instructional Package

The following sections of this report deal mainly with the development of course materials for construction. Manufacturing course materials followed a similar process.

Instructional Framework Generated for Construction

How to present the body of knowledge was a major question. Various alternatives were examined. Courses could be developed which systematically studied each group of concepts. However, such a study was rejected because it was devoid of particular construction and manufacturing contexts and special student interests. Thus, it was decided to develop "a story" of "what leads to what" so that the technologies would emerge in relation to the basic steps or processes of construction and manufacturing. Research of the literature revealed the lack of a comprehensive, generalized story of how construction takes place, from start to finish; instead, it revealed highly specific and detailed elements. It was not known at the time whether or not a common body of practice of construction processes could be identified.

In 1966, three researchers were employed to research and develop a story of construction. One was a doctoral candidate in industrial technology education, and the other two were master's students in architecture. These researchers analyzed the construction processes used to construct houses, buildings, roads, dams, bridges, towers, and tunnels. The analysis revealed a pattern of construction practices common to all structures. Care was taken during the analysis to list only concepts of practice (common actions) rather than tools

DEVELOPMENT OF INDUSTRIAL ARTS CURRICULUM PROJECT MATERIALS

Initial Development	First Edition	Second Edition	Third Edition	Fourth Edition
Invention Design Construction Assembly	School Testing Evaluation Revision	School Testing Evaluation Revision	School Testing Evaluation Revision	Final Edition Available
WORLD OF CONSTRUCTION				
Dec. 1966	Sept. 1967	Sept. 1968	Sept. 1969	Sept. 1970

Dec. 1967	Sept. 1968	Sept. 1969	Sept. 1970	Sept. 1971
WORLD OF MANUFACTURING				
Invention Design Construction Assembly	School Testing Evaluation Revision	School Testing Evaluation Revision	School Testing Evaluation Revision	Final Edition Available
Initial Development	First Edition	Second Edition	Third Edition	Fourth Edition

FIGURE 2

and materials. The structure or story was submitted to a panel of construction experts for a check on validity. Minor modifications were made in the sequence and terminology. A more detailed analysis of the construction process was made and the results were compiled in the document "Reading Assignment Outlines for Industrial Technology I, The World of Construction," the Industrial Arts Curriculum Project, Preliminary Draft, August, 1966. This document was presented to the IACP Advisory Committee for review during September, 1966. The document was approved.

The developmental work on the generation of a story of construction by the industrial technology education researcher gave impetus to the first of many theses related to the IACP program. Included in Hauenstein's thesis, Construction: A Taxonomy and Syllabus of Production Practices with Implications for Industrial Arts, was a preliminary format for textbooks, workbooks, laboratory manuals, teacher's guides, and achievement tests, as well as a structure of a body of construction practices. This study was a forerunner of further developmental and testing efforts in the Cincinnati Public Schools.

With an available story or general sequence of concepts, the basic elements of the construction course could be discerned. Assuming one instructional period per concept, the number of construction concepts was compared with the number of school days in a year, 165 minimum to 185 maximum. The difference between the number of basic concepts and the number of school-year days revealed a balance of about ten weeks. The total course plan was then studied to establish the overall course design. This study resulted in a course design including an introduction; an analysis of management and production concepts with personnel practices interspersed where applicable; a synthesis of construction concepts applied to a particular project, housing construction; and a synthesis of construction concepts applied to community development and to city and regional planning. The synthesis of housing construction was selected because it was felt that housing construction was most evident and within the students' immediate environmental experience. Housing construction would also be studied in the laboratory via model building with each student designing and building his "dream house." City and regional planning was selected to present larger social, long-range, decision making. A team of city planners from The Ohio State University were engaged to develop a game dealing with community development and the economics of city and regional planning. Outlines were generated to include the major concepts for each section of the course.

Design of Model Instructional System

After careful consideration of the total course design, the proposed general objectives of the program, the instructional materials to be supplied, the success of the test materials, and the daily teaching patterns, an instructional system was designed. The functions of out-of-class and in-class time segments were established. Prior to class, the student would study the textbook reading and answer questions and work problems in a workbook which was related to the textbook. In class, the teacher would guide a discussion or present a lecture or a demonstration or teaching aids that expanded the concept and related it to the laboratory activity and the local environment. Next, the teacher would ask questions to provide feedback evidence of student understanding of what he had read, heard, and seen thus far. The student would then engage in an activity causing him to apply the concept in a situation or to a problem representative of industrial practice. The teacher would then review the major elements of the concept being studied. Following the lesson, the teacher would evaluate the materials, activities, and procedures. Figure 3 provides a visual display of the daily instructional system.

It should be noted that Figure 3 shows the present instructional system. The difference between the initial plan and present plan is the placement of the review (now an overview) and the deletion of the workbook activity. A more comprehensive description of the Instructional Model can be found in the publication, "A Rationale and Structure for Industrial Arts Subject Matter" (Towers, Lux, and Ray, 1966, pp. 284-289).

Second Pilot Study

In February, 1967, a second pilot study was conducted in the Cincinnati Public Schools. As the preliminary pilot study determined the general procedures and problems of materials development and testing, a second pilot study was needed to (1) further refine the format of the instructional materials, (2) try out a specific concept from "The World of Construction" outline, (3) try out the materials with classroom teachers, and (4) refine the procedures for generating materials. The concept, "Setting Foundations," was selected from "The World of Construction" outline.

A text reading, workbook, laboratory manual, teacher's guide, achievement test, and necessary artwork and hardware were developed, printed, and distributed. The single lesson was taught by six teachers in the Cincinnati Public Schools to several seventh-grade

MODEL INSTRUCTIONAL SYSTEM FOR INDUSTRIAL TECHNOLOGY
For Any One Day of the Year
(DAILY TACTIC)

Instructional Elements	TEXTBOOK Reading (before class)	OVERVIEW	TEACHER PRESENTATION	DISCUSSION	LABORATORY ACTIVITY	EVALUATION
Instructional Functions	To present initial information within a conceptual structure. To verify application of concepts through problem solving.	To provide frames of reference for classork.	To bring concepts within perceptual range of learner. To clarify. To relate.	To verbally interact and expand meanings of concepts. To verify transfer of information.	To apply concepts to a representative particular. To verify ownership and application of knowledge.	To assess instructional elements. To recommend changes and improvements.
Teacher Functions	Preparing for class. Review instructional elements. Gathering supplies. Assessing past procedures.	Reviewing, Previewing concepts, objectives, procedures for the day.	Presenting information via presentation, visual aids, demonstrations. Relating, clarifying concepts, procedures.	Leading, directing, controlling, correcting, interacting.	Managing, organization, procedures, materials, activities.	Assessing instruction, activities, materials, procedures, objectives. Evaluating. Modifying.
Learner Functions	Reading text and responding to "Think-About-It" questions. Applying concepts, reorganizing relationships of concepts.	Perceiving general context; recognizing objectives, procedures, and concept relationship.	Perceiving concept relationships, enlarging range of understanding, recognizing procedures.	Responding to questions, building ownership of knowledge via verbalization.	Increasing level of concept ownership via application and performance.	Assessing personal learning experiences.
Terminal Performance Objectives	Cognitive Affective			Affective Cognitive	Psychomotor Affective Cognitive	
Class of Learning	Reactive	Reactive	Reactive	Interactive Reactive	Active Interactive	

FIGURE 3

classes. Suggestions for modifying the materials were gathered from the teachers and students. This test of the developmental system and teaching procedures aided in establishing a refinement of the developmental system and the instructional materials format.

The research associate implementing the pilot studies was moved to the position of curriculum materials specialist and charged with the supervisory responsibility for (1) establishing a means of controlling production, (2) the design of curriculum materials, (3) the generation of textbook outlines, (4) the generation of workbook questions, (5) creation of laboratory activities and manual, (6) establishment of the teacher's guide, and (7) the coordination of all developmental work in cooperation with the associate directors of the project.

Establishment of Production Control

In projecting the work to be accomplished, the need became apparent for a means of keeping track of each piece of material as it proceeded through its developmental cycle. Estimates were made that there would be approximately 103 text readings, 103 workbook assignments, 165 laboratory activities, and 185 teacher's guide assignments. A schema was needed to keep track of the development of these 558 pieces of material as they proceeded through the various stages of development.

A production control chart was designed to fulfill this need. A double entry chart was made with headings for each piece of material to be developed. The columns were subdivided into the eight major stages of production. The vertical axis of the chart was divided into 185 units, one line per day of the course. Reading titles and assignments were placed next to each day of the course. In effect, this chart contained the table of contents for the teacher's guide. Different colored pins for each piece of material were moved from step to step as the development occurred (see Figure 4). Shown in Figure 5 is the IACP Materials Development System.

The first semester software was printed while the hardware was being produced. All software and hardware materials then were packaged according to the requirements of each field evaluation school and shipped for distribution. The plan was to prepare teachers in the use of first semester materials as soon as they were received from the printer. As the teachers were teaching with first semester materials in the fall, September, 1967, the project staff was developing and producing the second semester materials to be used beginning in January, 1968. Teachers would learn of second semester materials at a mid-year conference.

PRODUCTION CONTROL CHART

Day	Title of Assignment	Textbook								Workbook								Laboratory Manual								Teacher's Guide								Hardware								
		*1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9
1	Optional																																									
2	Optional																																									
3	Introduction																																									
4	Man and Technology																																									
5	The Evolution of Manufacturing																																									

This type of control chart was used for both the original production of materials and the three revisions.

* Numbers indicate job sequence, see Figure 5.

FIGURE 4

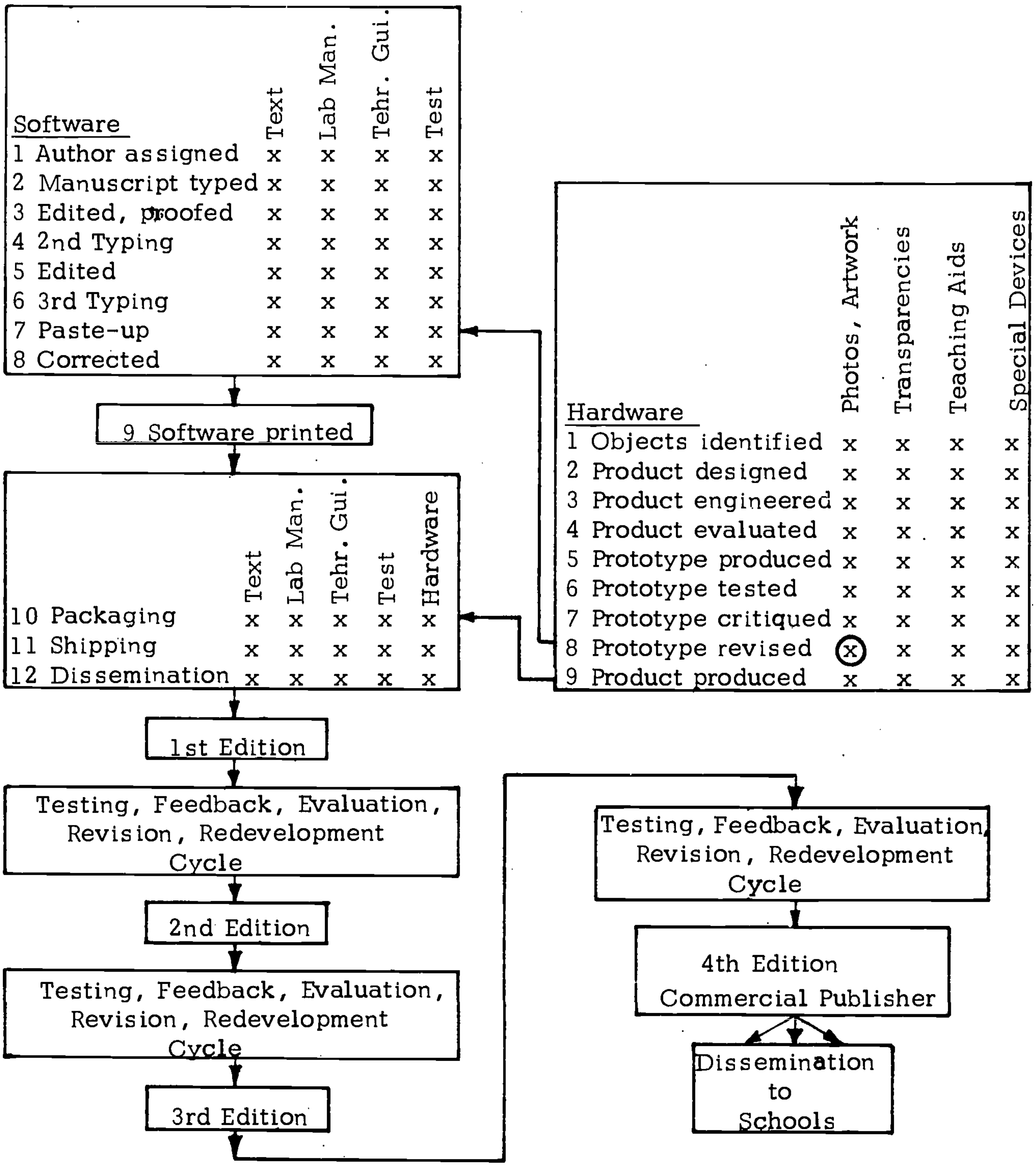
The Design of the Instructional Materials

Textbook. Several format designs were studied from various existing textbooks and laboratory manuals; for example, earth science, physics, biology, mathematics, English, and so forth. The format selected for the textbook was two columns per page, preferably one column of type and the other of illustrations. Readings averaged four to six pages that could be read in about 15 to 20 minutes. The reading title was placed at the top of each page opposite the binding. Each reading title carried an identification number. "The World of Construction" appeared on each page on the binding edge. (The number of pages for each reading were an even number of pages -- 2, 4, 6, etc. -- to facilitate production. Thus, these materials could be processed out of sequence.) The function of the textbook was to present initial student cognitive input about the story of construction, to expand the concepts of practice, and to provide information related to the concepts. Textbook readings were scheduled for outside of class time about every other day.

Workbook. The workbook -- a companion to the textbook -- was designed to provide evidence of student understanding via questions and problems. Workbook questions were to consume no more than 15 minutes of student time. A maximum of ten questions or completion type statements per reading were drawn from the text. A maximum of two problems per reading were included to provide an opportunity for the student to apply his knowledge in solving problems related to his home or school environment. The workbook was designed for two columns per page and to carry the same titles and numbers as the textbook. The workbook lessons were done after reading the text and prior to class. Each workbook assignment consisted of an even number of pages to facilitate production.

Teacher's Guide. The teacher's guide was designed to provide for each lesson: (1) the behavioral objectives, (2) time schedule -- for pacing instruction, (3) a list of all necessary teacher demonstration or presentation equipment and supplies, (4) a list of student-used equipment and supplies and quantities, (5) an overview of today's lesson or review of yesterday's lesson, (6) a teacher presentation or demonstration, (7) discussion questions and answers, (8) laboratory management procedures, (9) homework assignments, and (10) answers to workbook and laboratory manual questions and problems. An appendix listed the totals and specifications of IACP and school-supplied equipment, supplies, and special hardware required to teach the course.

IACP MATERIALS DEVELOPMENT SYSTEM



	Sept. 1967	Sept. 1968	Sept. 1969	Sept. 1970	Sept. 1971
Construction	1st. Ed.	2nd. Ed.	3rd. Ed.	4th. Ed.	
Manufacturing		1st. Ed.	2nd. Ed.	3rd. Ed.	4th. Ed.

FIGURE 5

Laboratory Manual. The laboratory manual was designed to provide interesting and meaningful activities which would help students to better understand the concepts and practices being studied. It included two columns per page, and carried the same titles and numbers as the textbook. It served as the students' guide in solving problems and conducting activities and was used in the classroom or laboratory. The laboratory manual also included a list of required equipment and supplies, a time schedule for completing the activities, and directions necessary for completing the activities.

Figure 6 displays a graphic plan of how the flow of the information was developed from the rationale, objectives, and course syllabus through to the achievement test.

Generation of Instructional Materials

Textbook Reading Outlines. Even though the major conceptual elements of the textbook had been identified at this point, a topical outline had to be generated to conform to the general conditions of the textbook format. Research associates, the curriculum materials specialist, and other staff members generated basic outlines for the analysis section of the course and the synthesis section for housing construction. The city and regional planning team developed the outlines for their synthesis section. In the analysis section, each technological concept or title in the story was analyzed and the practices and procedures for each step were identified. Basic to each outline were factors related to: what, how, when, where, why, and who. These outlines were reviewed by the staff and modified in relation to reading length and content overlap. Minor adjustments were made in the story; some readings were combined and others were divided into two readings. No work was done on the workbook until after the readings were written, because material in the workbooks was drawn from the readings.

Development of Workbook Questions and Problems. Following the development of the textbook reading assignment, related workbook questions and problems were generated. Workbooks were designed to provide guidance for students during the time they did their homework assignments. The initial part of each workbook assignment was designed to help students identify the most important learnings of the reading assignments. The second part of each workbook assignment helped students reinforce important learnings by providing an opportunity for them to test their understanding of the lesson by solving one or more related problems.

PLAN FOR INSTRUCTIONAL MATERIALS DEVELOPMENT

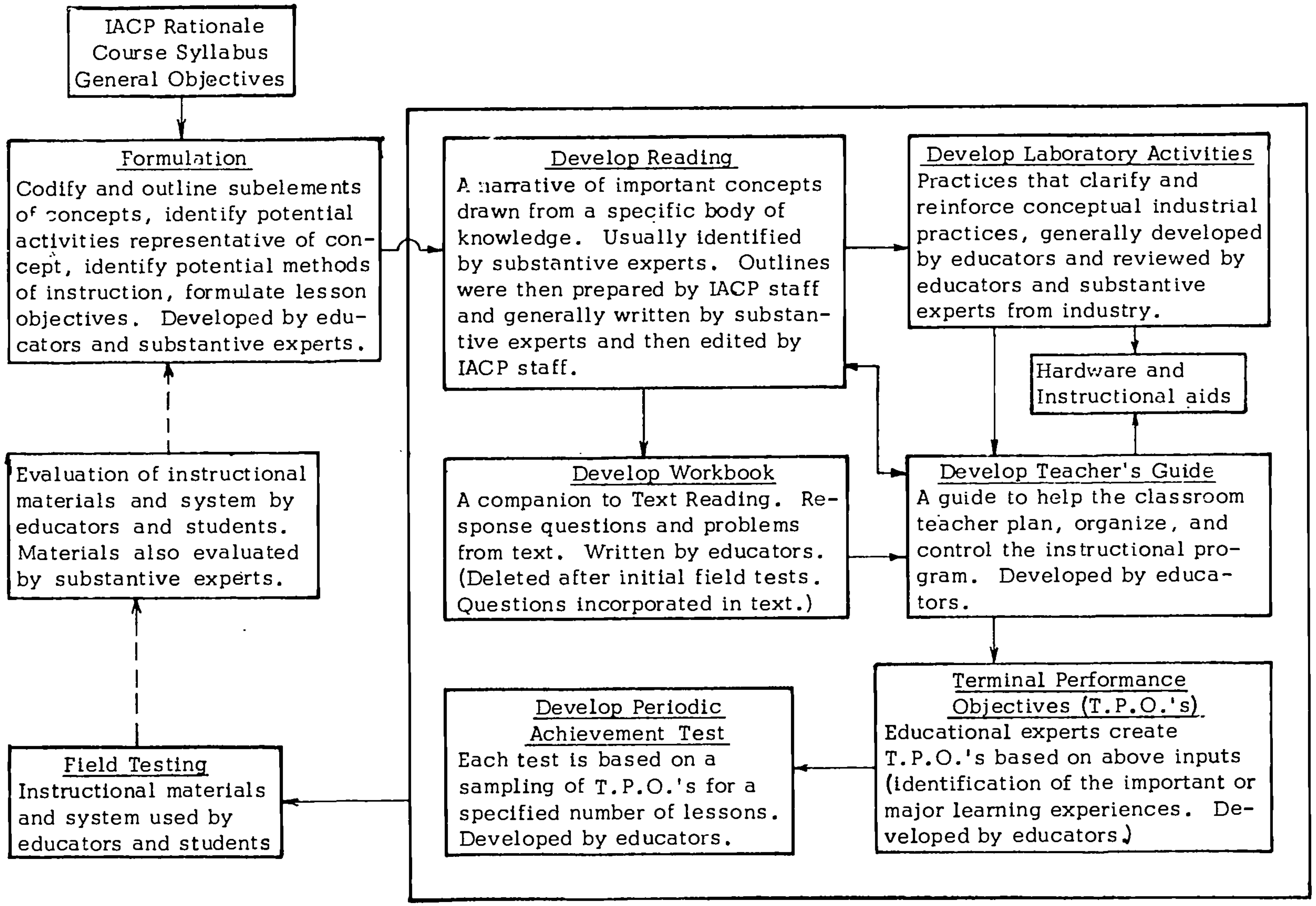


FIGURE 6

Creation of Laboratory Activities. Working from the textbook reading outlines, research associates and the curriculum materials specialist generated ideas for activities that were representative of the technological concepts. All activities were guided by the concepts to be learned. For example, if the concept was Surveying and Mapping, or Scheduling, or Earthmoving, these dictated what the activity must be. Students preferably would do surveying and mapping, scheduling, and earthmoving in class or at least perform in a situation representative of the concept under classroom constraints rather than in the field. Preliminary ideas for activities were generated by individual researchers and by group efforts. Ideas for activities were discussed and selected in relation to a number of factors: (1) classroom and laboratory facilities, (2) student interest, (3) student ability, (4) class organization and procedures, (5) time requirements, (6) materials, (7) tools, (8) equipment, and (9) cost. Brief descriptions of alternate activities were recorded for further review and development as necessary.

Generation of the Teacher's Guide Outlines. Using the text outline and the laboratory activity as a guide, outlines for the teacher's guide were created. Estimates were made as to the amount of time consumed by each activity. The difference between the activity time and the 45-minute periods identified time that could be allowed for teacher presentations, discussions, and reviews. Suggestions were made for lecture content necessary to clarify the concept and relate it to the activity. Also contained in the year's outline were 10 days designated for administering achievement tests, and 10 days for preview and/or review of the tests. In addition, a total of 20 optional days were specified to provide program flexibility for schools operating between 165 and 185 school days. Optional days were designed as extensions of previous activities that were desirable but not essential to the minimum understanding of the concepts under study. Thus, 40 of the 185 instructional periods were marked as review, test, or optional periods. These assignments were also outlined for further review and development.

Establishment of a Quality Control System. As outlines began to take shape, the need for standardizing the presentation of material became apparent. Forms were designed for the workbook, laboratory manual, and teacher's guide which carried headings, items, lines, and explanatory notes pertinent to each document. These forms served as a manuscript base to be filled in by development personnel. This built-in quality control, with regard to consistency of style and format, helped insure that each item on the form would be considered. Each form was placed in a folder marked text, workbook, laboratory manual, or teacher's guide and coded with a day number from 1 to 185. In addition, a set of standards for each type of instructional material was written for writers, editors, and artists; these instructions included such items as (1) purpose of the material, (2) conventions to be followed, (3) headings, (4) paragraphs, (5) directions for developing activities, (6) problems to consider, (7) general procedures, (8) author responsibilities, and (9) editorial responsibilities.

A routing sheet was attached to each folder. It was basically a duplicate of the eight production steps with a place for initials and dates. These routing sheets provided an immediate status report for the contents of each folder which could then be plotted on the master production control chart.

Construction of the Instructional Package

Identification of Authors

The first problem encountered in this area was the question: Who are the experts in construction? Contractors? Architects? Civil engineers? Tradesmen? A secondary question was: If an expert can be identified, can he, and is he willing to, write for the project for token remuneration? To answer the first question, researchers compiled a list of current authors and books on various construction topics. These authors (engineers, educators, contractors, representatives of trade organizations) were contacted, contracts were developed, assignments were made, an outline of responsibilities was assigned, and a set of instructions was mailed to each of those participating. Upon receipt of the manuscript, it was read and edited by the project staff, typed, and sent out to other experts in the field for review, modification, or rewriting. This double, sometimes triple, exposure of the material provided a check on its accuracy and authenticity.

Many man-hours were consumed in tracing addresses of potential writers, corresponding by mail and phone, travel for personal contacts, and conferences with the writers at IACP headquarters. Many writers contributed their time free of charge. Others were paid a token remuneration.

Writing schedules, assignments, and deadlines were established for the textbook rough manuscripts. Where voids existed in the assignment schedule, the staff generated the manuscripts. Readings on Man and Technology, Management Technology, Personnel Technology, Production Technology, and a few others were written by the staff and submitted for review to experts in the field.

Readings were written by personnel in various positions and fields of endeavor. Examples were: an engineer from the Office of Chief Engineer, U.S. Department of Interior; a civil engineer, Bureau of Engineering and Construction, Commonwealth of Pennsylvania; contractors; a civil engineer and surveyor; the director, Center of Science and Industry; a magazine editorial consultant, Information Research Group; personnel from the Ohio State Employment Service; an Assistant Vice President, J.A. Jones Construction Company; a coordinator, United Brotherhood of Carpenters and Joiners of America; a landscape architect; construction engineers; and professors of construction and engineering at various universities. A more substantial listing appears in the textbook, page ix, of the commercial edition of "The World of Construction." With regard to identifying authors of the workbook, laboratory manual, and teacher's guide, these were assigned to research associates and headquarters staff for writing "in-house."

Personnel

To accomplish the task of producing the required materials, a cadre of personnel was assembled, in addition to the six staff members. The following personnel were initially employed: seven typists, twenty research associates (in industrial technology education, administrative science, history of technology, architecture, city planning, and industrial sociology), one artist, and one editor. These figures are approximate, due to fluctuation in demand and availability.

Writing Manuscripts

Once the rough textbook manuscripts were received, they were processed according to the steps listed in Figure 5. Carbons of the text materials were inserted in the workbook folders for review and writing of the workbooks. The text materials were reviewed and questions and problems were generated. Answers to the questions and problems, related to each particular workbook assignment, were recorded and placed in the appropriate teacher's guide file.

The laboratory manuals and teacher's guides were written hand-in-hand; however, the laboratory manual had to be written first because the details of each activity had to be known in order to determine what demonstration and information inputs were needed to prepare the student for that activity.

The preliminary ideas for the laboratory activities were reviewed and the procedures for accomplishing each activity were generated. When activities involved materials and tools, they were physically performed by a research associate to determine the exact quantities of materials and preferred procedures for their execution. In the process, illustrations of procedures could be identified, photographs taken, and artwork suggested, with accompanying rough sketches. The teacher's guide manuscripts for each day were then generated. Even though all standardized forms were arranged in the format of the finished product, the manuscripts could not be written concurrently. First, the laboratory activity was described. Then the management, class organization, safety precautions, and teaching procedures for the achievement of the activity were written. Activity duration time was estimated and recorded under the time schedule. Next, the presentation or demonstration outlines were written. In many cases, the demonstration was performed by research associates to estimate the time, determine the procedures, and establish the materials and tools required. When illustrated presentations were required, sketches for transparencies were made, photographs for filmstrips or slides were suggested, and sketches for charts or graphs were prepared. The presentation time was then recorded.

When class time permitted, questions related to the text, workbook problems, and teacher presentations were generated, and appropriate answers were recorded. The answers by students, to the questions posed, would provide some evidence of their understanding. Discussion time was estimated and recorded. A list of equipment and supplies was recorded for the laboratory activity and demonstration.

The general performance objective for each problem activity was stated prior to initial writing and development. Since all reading and activity titles were in terms of verbal nouns (words ending in "ing"), the titles suggested the kind of performance to be described by the behavioral objectives. The specific objectives (T.P.O.'s) were written last due to a number of factors that influence or change the educational specifications. Some factors that modified or caused a change in the specific objectives were: (1) the activity was modified due to cost of materials and equipment needed, (2) the activity was not applicable to general laboratory conditions, (3) safety factors became prohibitive, (4) the time required for a desired activity was too long or short, (5) the activity was not as representative of the concept as it should be, (6) the activity was modified due to lack of student background experience and knowledge, (7) the activity lacked "boy appeal" and interest, (8) changes in text material caused changes in workbook questions and problems which caused a change in the objectives, and (9) course design changes required shifts in the sequence of activities.

Finally, the review of the lesson was written, pointing out pertinent concepts, objectives, and purposes. The next homework assignment was written, and answers to the workbook and laboratory manual questions and problems were checked. Both the laboratory manual and teacher's guide folders were reviewed, checked, edited, and passed on for the first typing.

Editing Manuscripts

Responsibilities for the editing of materials written were first assumed by the project staff during the creation of the IACP construction materials in 1966-67. Work tasks were divided; the responsibility for the construction textbook was assumed by an associate director, and the responsibility for the teacher's guide, workbook, laboratory manual, and auxiliary instructional materials was assumed by the curriculum materials specialist. Work proceeded as a cooperative venture.

As the abundance of materials increased, the administrative assistant to the director assumed the responsibility for age-grading the materials and rewriting for continuity and consistency. Working together, the team wrote and edited materials for consistency, validity, reading level, and appropriateness in relation to: headings, subheadings, context, verbiage, objectives, questions, illustrations, captions, equipment and supplies, spelling and grammar, time schedules, discussions, reviews, activity procedures, demonstrations, answers, safety precautions, references, and the like.

As the creation of manufacturing materials began in 1967, responsibility for the manufacturing textbook was assumed by the other associate director while the responsibilities for the laboratory manual, teacher's guide and auxiliary materials were assumed by graduate assistants and the curriculum materials specialist. All staff members contributed to the initial editorial work on manufacturing materials.

During this time, work was also being carried on in evaluation and revision of construction materials by the associate director, curriculum materials specialist, evaluation specialist, field staff, and research associates. Due to the increasing work load and materials production, an additional part-time editor was employed to facilitate consistency and age-grading of the materials.

As the work load of the construction and manufacturing programs reached their peak, another full time editor was employed. At that time, 1967-68, one associate director accepted the responsibility for construction and the other associate director assumed the responsibility for manufacturing textbooks. Laboratory manuals, teacher's guides, and auxiliary materials for both programs were coordinated through the curriculum materials specialist. All achievement tests were developed under the direction of the evaluation specialist by research associates. Editorial work was a cooperative task, with all materials being channeled through the editor.

As construction and manufacturing programs became established in the Field Evaluation Center schools, teachers and field center directors joined in the editorial responsibilities by marking copy and suggesting changes. After the field data were synthesized, field center personnel reworked the materials during the summer revision conferences at project headquarters. As editorial work diminished, editors were released from contract.

As the construction program was concluding in 1969-70, a part-time editor was employed to prepare the first copy for commercial printing. Here again, all materials were edited for validity, consistency, reading level and appropriateness. The project staff worked jointly with the publisher's editorial staff in preparation of the commercial materials.

During the concluding phase of manufacturing and the project (1970-71), the part-time editor was released and a full-time editor was employed. In cooperation with the project staff, this person was to complete the following tasks:

1. Revise the 3rd edition texts, teacher's guide, and laboratory manual of "The World of Manufacturing" with respect to continuity of subject matter, consistency of style, grammatical structure, and appropriate readability level. Before the commercial edition was set in type, the Rutgers University (Fry) Readability Scale was used to evaluate the readability level of both the 3rd developmental edition and the final revision of the text. Seventh grade readability was considered optimal. A slightly higher level was allowed for those readings in which polysyllabic terminology was not only desirable but unavoidable.

2. Evaluate feedback from Field Evaluation Center personnel; and incorporate suggestions, when advisable, in first and second semester instructional materials.

3. Proofread all galley proofs and page proofs on materials covering text, teacher's guide, and laboratory manual for both semesters.

4. Edit all manuscripts comprising the IACP Evaluation Report: the detailed and definitive historical account of the IACP, its genesis, structure, development, and implementation.

5. Edit a miscellany of materials designed to acquaint a variety of reading publics with the scope and import of IACP.

Illustrations and Hardware

Illustrations for the text, workbook, laboratory manual, and teacher's guide were identified as they were written and reviewed. A research associate was assigned the task of contacting industrial organizations for free glossy photographs. Over a thousand letters were sent out. Industrial support for the project's photograph needs was generous. A photo-morgue was developed in which photos were categorized and filed. Because of the lack of lead time between identifying needed photos and the procedures involved in obtaining them, the first semester set of materials lacked essential photographs to conform to the format design -- a column of illustrations per page. Where illustrations were critical, artwork was generated for the textbook and workbook.

Many photos were staged for the laboratory manual and teacher's guide in the process of trying out various activities. A research associate was assigned the task of taking pictures. The artist and research associates produced the necessary artwork.

Research associates assigned to various units produced phototype hardware, made up copy for filmstrips, slides, and charts, and made teaching devices and special laboratory equipment. Photographs of special hardware were taken and incorporated in the materials.

Camera-Ready Copy

As the various units proceeded through typing, editing, and retyping, they were pasted-up for photo copy. The units were not done in sequential order. The format which required an even number of pages for each unit provided the flexibility needed for continuous work on the materials without regard to sequence. When all units were complete, they were paginated in sequence. Final corrections were made on the first semester materials, and the materials were packaged and sent to the printer.

Hardware Production

The special instructional hardware was fabricated in the industrial arts laboratories at The Ohio State University by a group of research associates. Enough materials were produced for the classes of the twelve construction teachers who would be teaching the program in the fall of 1967. Specialized hardware and materials were also ordered for each school. These included such items as surveying simulators, specially designed jenny winch booms, and specially-sawed sheet plastic for modeling.

Shipping

When the software was received from the printer, and as the hardware was produced and received at headquarters, the materials were counted out and packaged for each teacher. Trucking firms were contracted to ship the materials. All materials were received by the Field Evaluation Center teachers prior to the first day of school in September, 1967.

Certain quantities of materials also were produced and stored for use in the summer 1967 teacher education workshops.

Continued Development and Production of Materials

According to plan, while the first semester materials were being taught, the project staff was inventing, developing, and producing the initial second semester materials. The same basic production system was used to produce the second semester materials as was used for the first semester materials. Various improvements in the production of materials began to show. The photo-morgue was accumulating, thus making more and better selections of illustrations available for use. Due to early feedback from the field evaluation teachers, the type size of the copy was enlarged. The purchase of a headliner, waxer, IBM ball typewriter, and more art equipment provided the means by which the page design could be improved. The standardized forms for the manuals were revised to reflect the improved format. Adjustments were made in personnel and procedures. Typists began to specialize in typing materials for texts, workbooks, laboratory manuals, or teacher's guides. Closer quality control was imposed on the typists. A full-time editor was employed. Writing and development continued on schedule even though the project was interrupted by moving from off-campus facilities to campus housing.

During the invention of second semester materials for construction, personnel were reorganized and work was started on the invention of "The World of Manufacturing." Basically the same system was used to invent, design, engineer, develop, and produce the manufacturing materials. The same format for instructional materials was used for manufacturing as was used in construction. Writers with expertise in manufacturing were identified and contracted. Outlines were generated, activities and demonstrations created and worked out, illustrations and visuals obtained, hardware designed and produced, materials tried out, manuscripts typed, edited, corrected, and produced as photocopy, to be ready for printing in July, 1968.

Revising the Instructional Program

The first summer revision conference for construction materials was held in 1968 to rewrite and improve the materials for the construction course. It involved the employment of construction teachers from the Field Evaluation Centers in addition to headquarters staff. Also, during the summer of 1968, workshops were held to prepare twelve additional construction teachers, in order to expand the field testing of the second edition construction materials, and twenty-four manufacturing teachers who would field test the first edition manufacturing materials.

During the three-year developmental cycle, and as a result of feedback from the Field Evaluation Centers, major additions and changes were made. These major changes were:

1. The workbook was discontinued and some of the questions were incorporated at the end of each reading;

2. The review at the end of each period (teacher's guide) was changed to an overview at the beginning of each period;

3. Behavioral objectives were included in the laboratory manual;

4. A list of safety precautions was included in the teacher's guide and laboratory manual;

5. A more detailed appendix list of equipment, teaching aids, and expendable materials was developed;

6. An overall improvement of artwork and photos was made;

7. Time for city and regional planning was reduced from approximately five weeks to two weeks;

8. Time for the unit on housing construction was extended;

9. Numerous activities in construction and manufacturing were changed to make them more relevant, interesting, and exciting;

10. Four sets of readings in construction were combined into two readings;

11. Four sets of readings in manufacturing were combined into two readings;

12. The course design in manufacturing was reorganized;

13. Numerous errors in all the materials were removed;

14. Consistency in the use of materials was improved;

15. The reading level in both courses was lowered for 7th and 8th grade students; and

16. Cover designs on all materials were improved.

Table 2 is a summary of IACP software instructional materials output. It should be noted that these figures represent finished photo-copy pages and do not reflect the thousands of pages of rough manuscript, first and second typings, and unused manuscript. Table 3 represents the final hardware output and does not reflect the hundreds of prototype hardware items that were designed, engineered, and developed, but abandoned in favor of improved items.

IACP INSTRUCTIONAL MATERIALS OUTPUT
SUMMARY OF SOFTWARE

Software Items	1967-68	1968-69	1969-70	1970-71	Development Total	McKnight & McKnight
Textbook pages	C 542	C 606 M 500	C 578 M 466	M 474	C 1726 M 1440	C 560 M 520
Laboratory Manual pages	C 542	C 600 M 588	C 432 M 448	M 533	C 1574 M 1569	C 372 M 375
Teacher's Guide pages	C 804	C 689 M 742	C 569 M 695	M 700	C 2062 M 2137	C 310 M 368
Achievement Test pages	C 60	C 60 M 60	C 60 M 60	M 60	C 180 M 180	C 42 M 42
Workbook pages	C 280	C 230 M 150			C 510 M 150	
				Total Pages of Photo Copy	11,528	2,589

'C' represents Construction
'M' represents Manufacturing

TABLE 2

IACP INSTRUCTIONAL MATERIALS OUTPUT
SUMMARY OF HARDWARE

Hardware Items	1967-68	1968-69	1969-70	1970-71	Development Total	McKnight & McKnight
Filmstrips and Slide Sets	C 0	C 6 M 19	C 5 M 16	M 16	C 11 M 51	C 5 M 17
Transparencies	C 109	C 65 M 34	C 87 M 105	M 124	C 261 M 263	C 91 M 87
Jigs and Fixtures	C 1	C 1 M 28	C 3 M 20	M 42	C 5 M 90	C 3 M 43
Special Teaching Aids	C 51	C 39 M 34	C 39 M 12	M 8	C 129 M 54	C 52 M 10
10 Minute Color/Sound Films		C 3			C 3	
'C' represents Construction 'M' represents Manufacturing				Total Number of Items	867	308

TABLE 3

Figure 7, IACP Development of Curriculum Materials, shows a typical schedule for a year's production. Involved are mid-year and summer evaluation and revision conferences. The schedule also shows the termination schedule for construction and the IACP role with a commercial publisher, McKnight & McKnight Publishing Company.

Feedback - Field Evaluation Centers

Collecting and utilizing feedback for revising the construction and manufacturing courses of IACP amounted to a considerable task. A policy which had a definite effect on the entire feedback process was the decision to revise both "The World of Construction" and "The World of Manufacturing" experimental materials three times prior to producing the commercial edition. Because of the imprecision with which one can predict the effect of such variables as student interest, instructional effectiveness, and time constraints, this revision schedule was thought to be an adequate procedure for testing and refining the instructional materials before they were made available for widespread distribution and implementation. The revision schedule adhered to by the project staff appears below in Table 4. A review of the extent of the necessary revisions in each successive edition, confirms the judgment that such a developmental cycle was necessary.

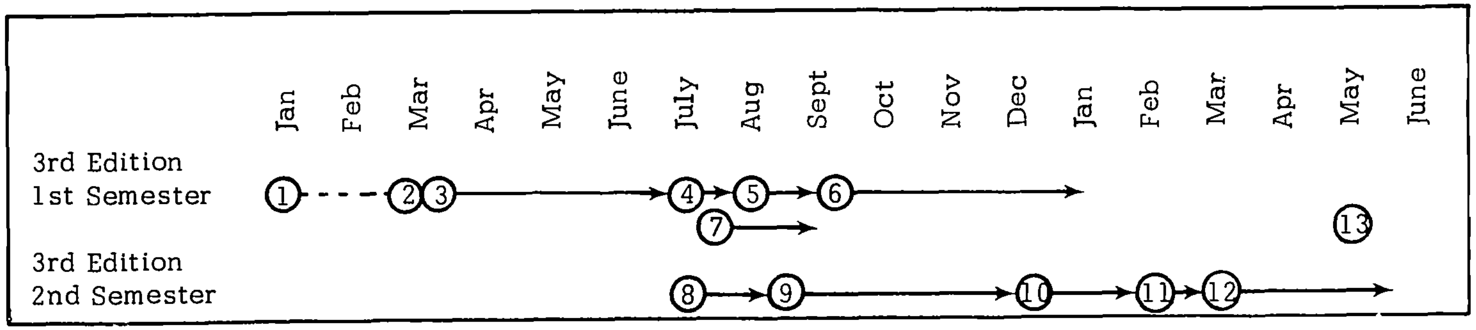
REVISION SCHEDULE

Construction					Manufacturing				
Sem.	Rev.	Ed.	Compl.	Availability	Sem.	Rev.	Ed.	Compl.	Availability
1	1st	2	6/68	7/68	1	1st	2	6/69	7/69
2	1st	2	11/68	12/68	2	1st	2	11/69	12/69
1	2nd	3	6/69	7/69	1	2nd	3	6/70	7/70
2	2nd	3	11/69	12/69	2	2nd	3	11/70	12/70
1	3rd	4	5/70	8/70	1	3rd	4	3/71	8/71
2	3rd	4	5/70	8/70	2	3rd	4	5/71	8/71

Commercial Edition

TABLE 4

IACP DEVELOPMENT OF CURRICULUM MATERIALS



Schedule	Production
1 Preliminary Conference	290p. Text
2 Mid Year Revision Workshop	320p. Lab. Man.
3 Software-Hardware Development	317p. Teacher's Guide
4 Printing	5 Tests
5 Shipping	2 Filmstrips
6 Teaching 1st Semester	66 Transparencies
7 Teacher Education Workshops	7 Jigs & Fixtures
	5 Special Items
	1 Slide set

Schedule	Production
8 Summer Revision	176p. Text
9 Software-Hardware Development	128p. Lab. Man.
10 Printing	376p. Teacher's Guide
11 Shipping	5 Tests
12 Teaching 2nd Semester	11 Filmstrips
13 Teacher Educator Conference	46 Transparencies
	32 Jigs
	11 Special Items
	2 Slide Sets

MCKNIGHT & MCKNIGHT PUBLISHING CO.
4th Edition
IACP EDITING AND PROOFING
Text, Lab Manual, Teacher's Guide, Tests, Filmstrips, Transparencies, Jigs & Fixtures, Slides, Special Items

Mar. 1970	Aug. 1970	Sept., 1970	Construction
Jan. 1971	Aug. 1971	Sept., 1971	Manufacturing

School Year Starts

FIGURE 7

Besides considering the detailed revision schedule, one needs also to consider the volume of information which was received as part of the feedback process. Eventually, as the project progressed, feedback was solicited from a total of 48 teachers, located in 24 schools, throughout the United States. Feedback was also requested from these teachers on a daily basis which involved the complete instructional package. Certainly, when one considers the magnitude of this problem, the need for adequate planning becomes obvious.

In order to have a functional system for obtaining and utilizing feedback, essential planning decisions were made concerning five basic questions:

1. What aspects of the program require feedback?

2. Who will provide feedback?

3. How will the feedback be obtained?

4. What system will be used to collect and condense feedback?

5. What system will be used to receive, store, and use the feedback for revision purposes?

A simple answer to Question 1 was that all aspects of the instructional program would require feedback. In more specific terms, project personnel identified five areas of the instructional package from which feedback would be desirable. Originally these areas were the textbook, text workbook, teacher's guide, laboratory manual, and achievement tests. Since the text workbook was eliminated as part of the instructional package (because of feedback from students, parents, etc.), feedback was focused on the remaining four areas.

Question 2 asks who will provide feedback. In this respect, just about anyone affected by or involved with the program was asked to contribute information relating to particular or overall aspects of the program. Emphasis, however, was placed on obtaining the daily reactions of students and teachers directly involved with the program. Feedback was also obtained from parents, school administrators, program visitors, college and university educators, and substantive specialists associated with manufacturing and construction.

Question 3 concerns the way in which feedback was obtained. Five methods were used to accomplish this task and are identified below.

1. Teachers were asked to complete evaluation feedback forms after each day's activity. They were also requested to make suggestions for improvement of software materials by writing directly on the developmental copy. Examples of the "marked copies" and the daily evaluation forms can be found in Appendix A and B. It should be noted that the daily evaluation form was revised twice during the course of the program.

2. Achievement tests obtained from the students in the Field Evaluation Centers provided valuable feedback concerning attainment of educational objectives.

3. Periodic questionnaires completed by students, teachers, parents and school administrators, who were directly involved with the program, was another source of feedback.

4. Feedback was obtained by soliciting reactions from consultants and other persons associated with the dissemination phase of the project.

5. Reactions were also solicited from visitors to the Field Evaluation Center schools.

Question 4 deals with the system designed to collect and condense feedback. The major concern here was the daily evaluation performed by the teacher. A method was designed to condense the feedback from each Field Evaluation Center so it would be useable upon arrival at project headquarters.

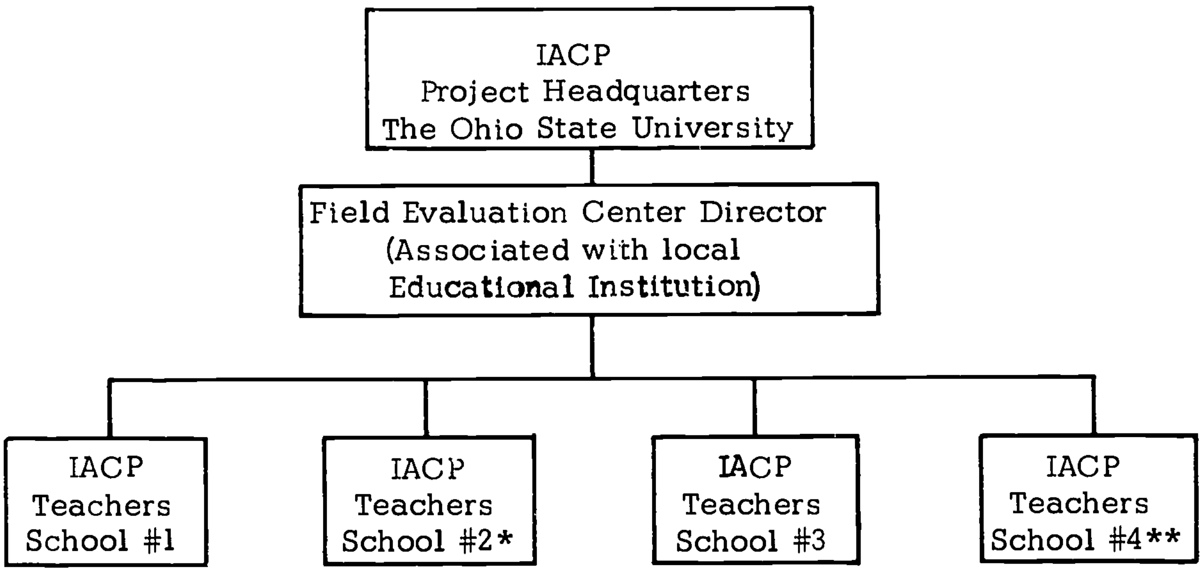
The personnel chart shown in Figure 8 illustrates that the Field Evaluation Center would be the most appropriate point for condensing the feedback prior to arrival at project headquarters.

To accomplish the task of condensing feedback, each Field Evaluation Center held a weekly meeting which involved all IACP teachers and the Field Evaluation Center director. The primary purpose of the weekly meetings was to:

1. Arrive at a consensus concerning problems experienced with the instructional package during the past week.

2. Use group processes to suggest solutions to these problems.

PROJECT PERSONNEL CHART



* Signifies Field Evaluation Center Head Teacher, Construction
** Signifies Field Evaluation Center Head Teacher, Manufacturing

FIGURE 8

3. Make necessary plans for the coming week.

4. Prepare a written report of the meeting and transmit it, along with daily feedback from the previous week, to project headquarters. The Head Teachers in manufacturing and construction were responsible for preparing their respective reports.

A graphic illustration of the feedback process described above is illustrated in Figure 9.

The structure of the field evaluation test centers also served as an effective means for administering periodic questionnaires to students, teachers, parents, school administrators, and visitors. Instruments of this type were administered through the Field Evaluation Center system and were returned to project headquarters for interpretation.

The final question relates to storing and utilizing feedback for the revision process. As the weekly feedback packets arrived from the various Field Evaluation Centers, they were sorted, grouped and

FLOW OF FEEDBACK FROM IACP TEACHERS

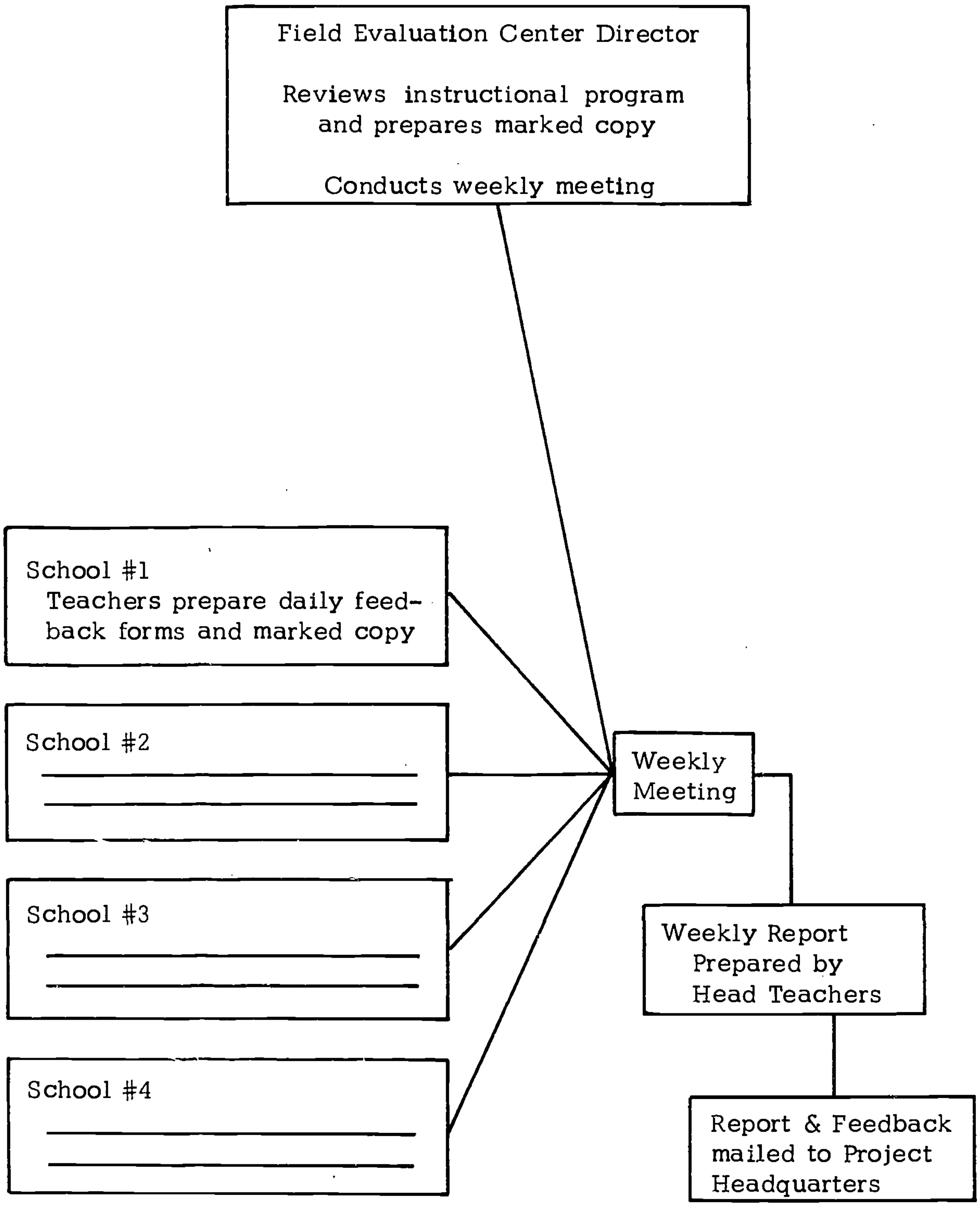


FIGURE 9

filed according to the daily instructional sequence listed in the teacher's guide. Thus, when project staff were ready to make revisions of a particular activity, all of the feedback material for that activity from each participating Field Evaluation Center could be found in one folder.

Because of the desire to include Field Evaluation Center teachers in the actual revision process, revision conferences at OSU were scheduled during the middle of the school year and in summer periods so that these teachers could attend. Besides these selected personnel from the Field Evaluation Centers, project personnel at IACP headquarters and, to some extent, substantive specialists were also involved in the revision conferences. The substantive specialists served primarily as a consultative body and worked closely with project staff in developing and refining the textbooks for construction and manufacturing.

It should be noted that the materials revised during the revision conferences were in rough form only, and considerable effort was still necessary to move the rough copy to a final draft which was typed, edited, age-graded, retyped, proofread, illustrated, and made ready for commercial reproduction.

Concurrent with the revision of the software materials, hardware, mostly in the form of jigs and fixtures, was also being revised and mass-produced by project personnel. Completed production of the revised hardware, transparencies, and filmstrips was scheduled to coincide with the arrival of the revised software from the commercial printer. Proper quantities of software and hardware were then packaged at project headquarters and shipped to individual schools within the six Field Evaluation Centers. The process described above generally represents the sequential procedure required to accomplish each revision.

The entire process of feedback, especially as it related to the revision of the instructional program, required a high degree of planning, organizing, and controlling. Without the cooperation and expenditure of many hours of time by people directly involved with the testing of the project, feedback would not have been forthcoming. Because feedback was solicited from many people, there was a definite need for condensing and organizing the information so that it could be used reliably and efficiently for revision purposes. Finally, because of the number of people involved and the enormous volume of feedback material to be received, it was imperative that a system of control be established from the local school to project headquarters.

Summary

This chapter contained a chronology of the research and developmental efforts of the major product of the IACP: a two-year junior high school industrial arts instructional system. The first section of this chapter briefly described the research completed toward the goal of conceptualizing the structure of the body of knowledge of industrial technology. Following this, the development and testing of the syllabus for the instructional system were reviewed.

The criteria, constraints, and administrative schedule (PERT) for the development of the proposed instructional package were presented. This information provided the referent for the generation of the instructional framework, the instructional system design, criteria, the pilot tests, and the methodology of producing and assessing the instructional materials.

The next chapter will set forth the rationale and operation of the project evaluation system and show the interrelationships of the research, development, and evaluation phases of the IACP.

CHAPTER III

EVALUATION OF IACP

Rationale

The evaluation activities of the IACP were designed to provide feedback for improving the various components of the instructional system. They involved a continuous, ongoing process. Professional staff and resources were committed to accomplish evaluative tasks as a means of providing internal evaluation of the project. This goal was partially accomplished through the utilization of a network of Field Evaluation Centers. The project staff also recognized the need for some form of external evaluation. Therefore, Demonstration Centers were established, in a variety of educational settings, and these local school systems were then asked to provide independent evaluations of the IACP instructional programs.

The major goal of the evaluation staff was to provide information that would provide guidance and direction for the improvement of the total research, development, evaluation, and dissemination efforts of the IACP.

Evaluation was viewed as reflecting all systematic efforts of the project in order to assess the strengths and weaknesses of its processes and products and their usefulness through measurement of (1) behavioral change or goal attainment, (2) the effectiveness of instructional procedures, and (3) the appropriateness of objectives. This chapter presents a review of the strategy and techniques used to evaluate the IACP.

Questioning Process and Goals

A questioning process was necessary to establish what was to be evaluated as a starting point for implementing evaluation strategies. Questions were grouped into the three behavioral domains -- the cognitive, the affective, and the psychomotor. Information on these three domains came from (1) Bloom (1956) and Mager (1962), the cognitive domain; (2) Krathwohl (1964), the affective domain; and (3) Simpson (1966), the psychomotor domain.

Using the three domains on one axis, a questioning matrix adapted from the EPIC cube (Hammond, 1968) was constructed, as shown in Figure 10. The behavior dimension then was composed of the cognitive, affective, and psychomotor domains; the program dimension contained organization, content, method, software, hardware, facilities, and cost; and the population dimension included students, teachers, supervisors (field center directors), administrators, parents, subject experts (writers, editors, artists and illustrators, laboratory technicians, advisory committee, etc.), and organizations (companies, unions, associations, publishers, etc.) Questions were then posed by combining the three dimensions of the matrix in each particular cube.

In addition to considering the overarching questions developed using the matrix, the goals of the project also had to be given due consideration. These goals were:

1. To formulate a new structure of the body of knowledge of industrial technology and a syllabus;

2. To design an effective two-year articulated program of study for industrial arts in the junior high school;

3. To develop teaching materials which can be used successfully in existing schools, with representative industrial arts teachers, and with pupils of all ability levels;

4. To install and evaluate the effectiveness of the program and materials in evaluation and demonstration centers throughout the United States;

5. To provide industrial arts teachers with orientation and inservice programs which will enable them to adapt to the new materials and procedures; and

6. To promote the dissemination, adoption, and adaptation of the IACP program.

What to Evaluate

It was necessary to identify those items of information that would be of most value in making decisions about program revision. It was determined that information could be collected and used effectively to evaluate and improve:

QUESTIONING MATRIX

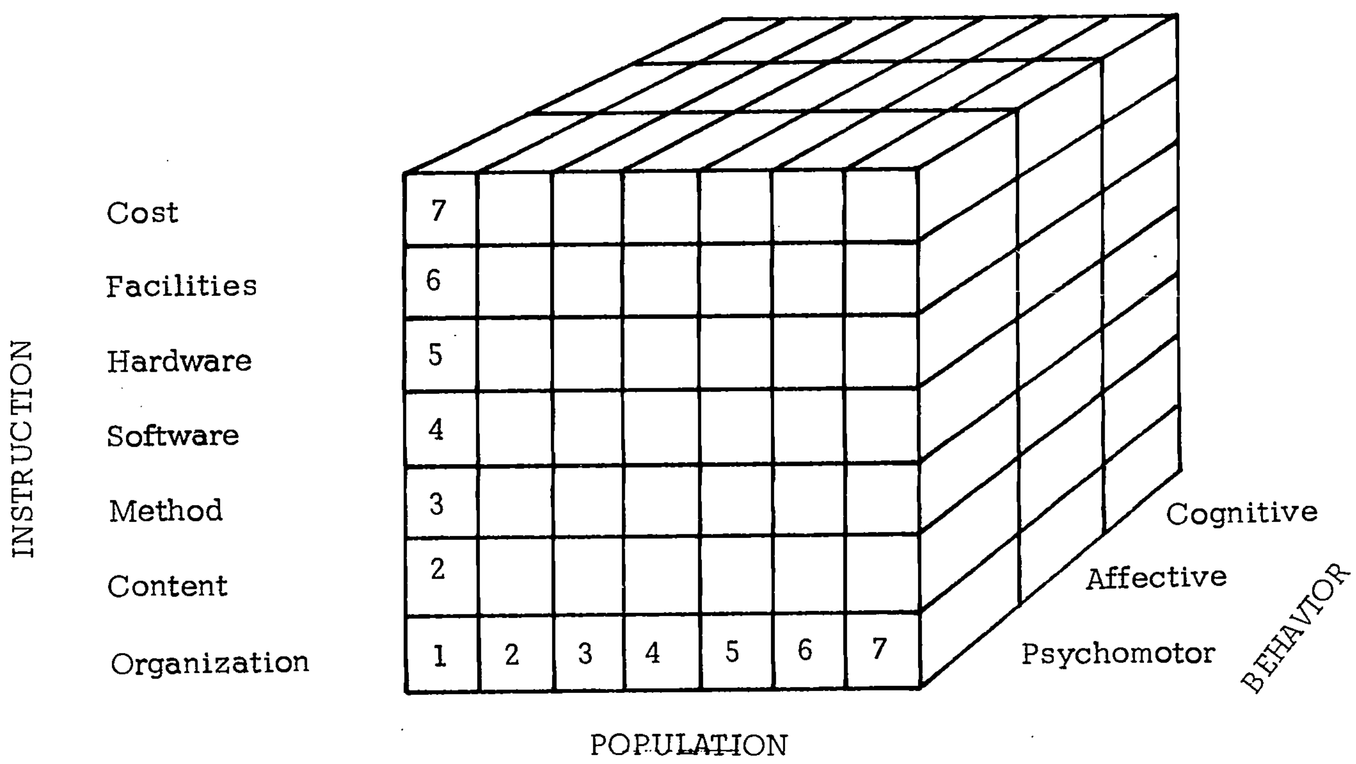


FIGURE 10

1. Objectives - overall and daily
2. Procedures - program and instructional
3. Materials - hardware (jigs, fixtures, filmstrips and special teaching aids) and software (textbooks, workbooks, laboratory manuals, teacher's guides, tests).

In addition to determining what was to be evaluated, it was necessary to establish evaluation criteria. The following general criteria were initially identified:

1. Content - completeness and accuracy
2. Time - correctness of allocations
3. Interest - appeal to students, teachers, and other interested individuals
4. Ability - appropriateness for students and teachers
5. Functionality - can be efficiently and effectively installed in public schools

<u>How to Evaluate</u>

It was decided that one of the best sources of evaluative information was the educational practitioner and that a Field Evaluation Center approach was more feasible than an individual school approach. The following is a summary of the IACP rationale for field testing:

1. Evaluation centers would represent various geographical areas in the United States.

2. Evaluation centers would include more than one school from a school system in order to provide greater involvement.

3. Coordination within a given geographic area is vitally important to program success.

4. Because of a wide geographic spread, provision for centralized visitation within a geographic area and centralized data reduction within a geographic area is essential.

5. Provision should be made for several teachers within a geographic area to meet together and work out the problems relating to initiating a new school program.

6. Teaching an IACP course should be a teacher's primary responsibility.

7. Provision should be made for feedback from individuals as well as from groups within a geographic area.

Achievement tests, questionnaires, and anecdotal reports were identified as valuable data-gathering instruments to be used in these Field Evaluation Centers. The professional staff from the Field Evaluation Centers would also participate and report evaluation information at mid-year and summer conferences. Feedback from the national advisory committee and the evaluation committee also was considered important, as was feedback from expert substantive consultants and from dissertations and theses completed by IACP graduate staff members.

Strategy

The evaluation strategy which evolved from the rationale had to include a classroom tryout of the materials (called formative evaluation), and an assessment of the finished product (called summative evaluation). As illustrated in Figure 11, there was no clearcut distinction between these two phases; the formative evaluation did not stop before the summative began and there was much interaction involved.

There also was a need to collect data that would assist decision makers in making judgments regarding the adequacy of the instructional system for local adoption (called intraschool evaluation). Although much of the information derived from the formative and summative phases was appropriate to meet this need, additional instruments and techniques were incorporated.

A final and more complete evaluation model was developed (Figure 12). The five phases of this model were also not mutually exclusive, but involved much interaction and recycling and were identified to assure an adequate supply of information at critical points during development and implementation.

Formative Evaluation

Formative evaluation was the quality control phase for the program elements during their initial development and subsequent revisions. These evaluation tasks were performed prior to actual field testing, using substantive experts, pedagogists, and IACP staff. These people developed objectives, procedures, and materials using such quality control procedures as: validation of content by expert review, pilot testing of model units with pupils, editing of written material for format consistency, and editing written materials for grammatical correctness.

Software and hardware materials were tested in pilot schools for the following:

Software

1. Appropriate educational specifications
2. Valid and accurate representation
3. Complete and adequate coverage
4. Appropriate readability level
5. Format consistency
6. Grammatical correctness
7. Error-free copy
8. Can be effectively used by children
9. Appropriate operational directions and procedures

Hardware

1. Appropriate to meeting educational specifications
2. Functional
3. Operationally adequate (can be effectively used by children)
4. Error-free (student-proof)
5. Adequate specifications (for ordering materials, fabrication, and operation)
6. Safe

This same kind of quality control procedure was applied to the development of daily and overall objectives and program and instructional procedures.

Summative Evaluation

The summative evaluation phase examined whether the instructional materials, sequence, and teaching methods provided a valid solution to the attainment of the educational specifications. It provided data on procedures, objectives, administrative reactions and recommendations, teacher reaction and recommendations, student interest and involvement, and supervisory feedback. These data then were used to revise subsequent instructional objectives, procedures, and

EVALUATION STRATEGY

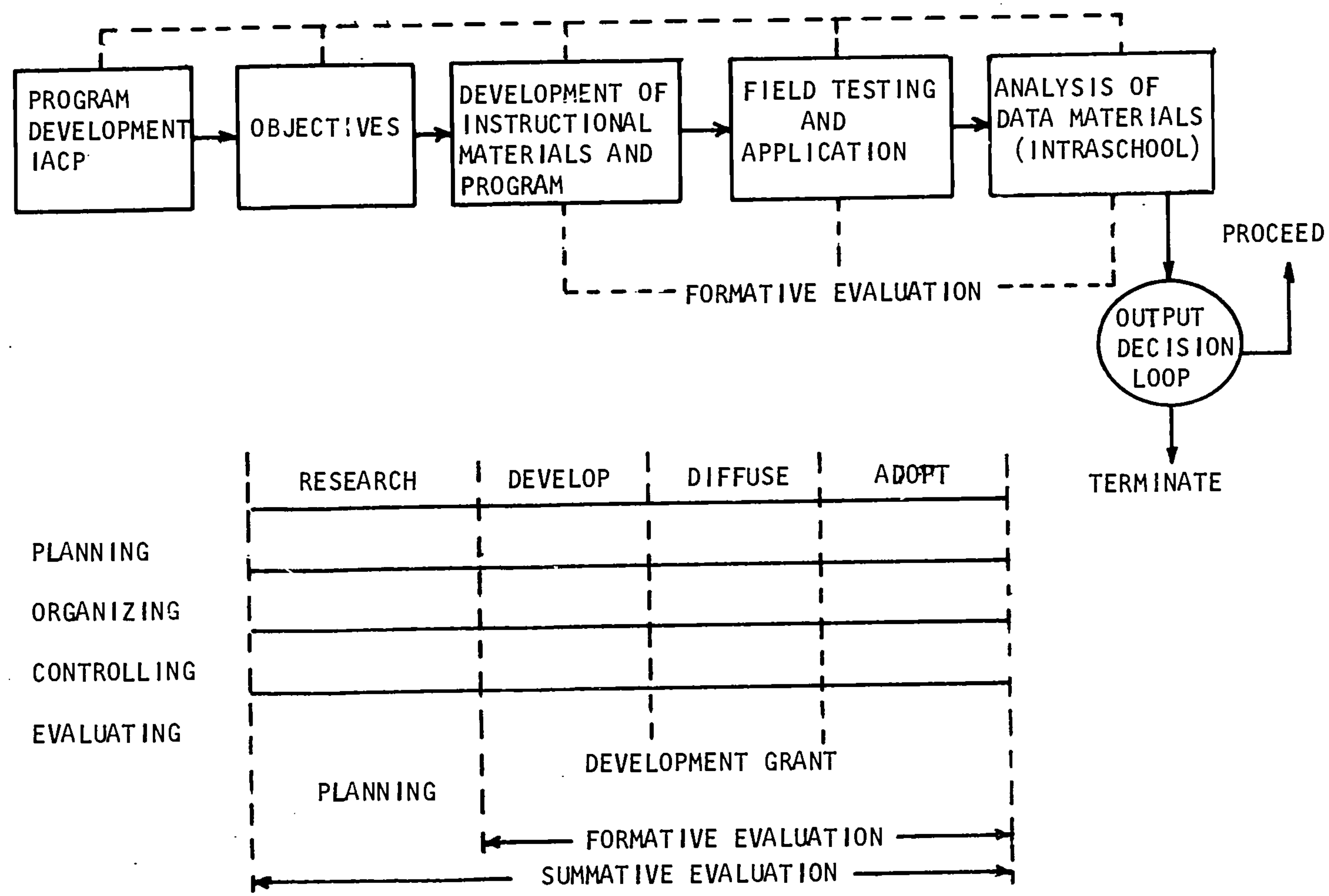


FIGURE 11

IACP MODEL FOR THE DEVELOPMENT, EVALUATION, AND REVISION OF INSTRUCTIONAL MATERIALS

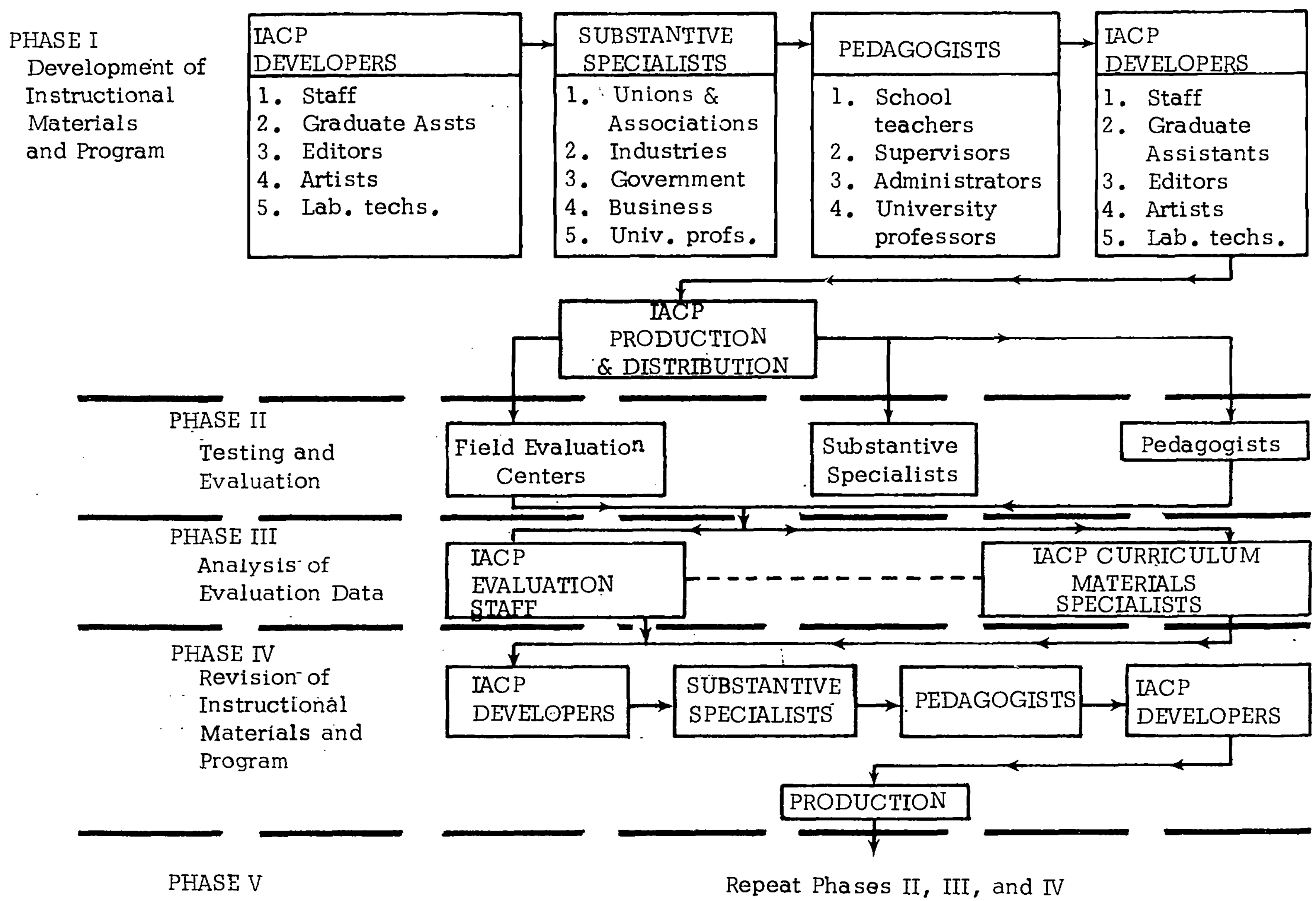


FIGURE 12

materials for maximum accuracy, appropriateness, effectiveness, and efficiency. These data were provided by:

1. Daily teacher's evaluations via marked copy and feedback forms
2. Weekly group evaluation meetings by Field Evaluation Centers
3. Mid-year evaluation conferences
4. Summer evaluation conferences
5. Occasional questionnaires
6. Field visitation by headquarters staff (observation, interviews, and group sessions with teachers, pupils, and administrators)
7. Anecdotal reports
8. Achievement tests and attitudinal scales

The data were then applied, where appropriate, to:

1. Correct and modify software and hardware
2. Prepare new manuscripts for software
3. Design and manufacture new hardware
4. Create new audio-visual media (slides, transparencies, and films)
5. Recommend changes in teaching strategies and program design

The data were gathered from students, parents, administrators, field center directors, substantive experts, and pedagogists.

Intraschool Evaluation

The intraschool evaluation phase provided data and procedures to aid educational decision makers regarding the adequacy of the instructional program for local adoption. Consideration was given to such questions as:

1. Is the IACP program compatible with the philosophy and goals of the local school system?

2. How can the IACP program be efficiently implemented and installed in the local system? Some subquestions examined related to:
   a) staffing
   b) teacher preparation
   c) laboratory space

d) laboratory equipment needs
e) budget analysis
f) program scheduling
g) appropriateness for student population

3. Is the IACP program economically and educationally successful? Do student achievement performance and interest warrant its adoption?

4. How effective is the IACP program regarding educational and social development of children? What are the relative merits and student outcomes of IACP courses compared to conventional industrial arts courses?

5. Are parents satisfied with the educational goals, activities, and outcomes of the IACP instructional program?

Some examples of activities conducted within the intraschool phase of the evaluation were: developing procedures for comparing the goals and objectives of the IACP instructional program with those of the school system, developing cost analysis procedures, developing procedures for local trial and evaluation, collecting data on educational achievement resulting from the instructional program, and compiling the educational and operational characteristics of the curriculum package. The greatest emphasis was placed on the analysis of data-gathering instruments; appropriateness of methods, materials, and objectives; student interest and involvement; and teacher behavior. The intraschool evaluation was accomplished through the cooperation of six Field Evaluation Centers and ten Demonstration Centers. Data were provided through:

1. Questionnaires completed by IACP administrators (principals), teachers, students, and parents
2. Personal interviews with IACP administrators
3. Mid-year evaluation conferences
4. Summer evaluation and revision conferences
5. Achievement tests and attitudinal scales

Many of the data were collected independently of the project staff by Demonstration Center personnel and independent evaluation specialists hired by the Demonstration Centers.

Revision Process

Each of the two courses completed a cycle of creation, development, evaluation, and revision including the formative, summative, and intraschool phases, four times prior to appearing as a commercial product. Many people were involved in the evaluation process through which data were supplied to revise the instructional materials.

Evaluation Advisory Committee

An Evaluation Advisory Committee of five members was originally organized for the purpose of providing counsel and advice on the installation of evaluative techniques and practices for the overall evaluation of the project. The initial committee consisted of the following five members:

Dr. David L. Clark, Dean
School of Education
Indiana University

Dr. Egon Guba, Assistant Dean
for Academic Affairs
School of Education
Indiana University

Dr. J. Thomas Hastings, Director
Center for Instructional Research and
Curriculum Evaluation (CIRCE)
University of Illinois

Dr. Robert W. Heath, Research Associate
Center for Research and Development
School of Education
Stanford University

Dr. Robert D. North, Associate Director
Professional Examinations Division
The Psychological Corporation

Later, the committee was restructured to include only the following members during the final phase of the project:

Dr. Daniel Stufflebeam, Director
Evaluation Center
The Ohio State University

Dr. J. Thomas Hastings, Director
Center for Instructional Research and Curriculum
Evaluation (CIRCE)
University of Illinois

Dr. Walter Foley, Director
Iowa Educational Information Center
University of Iowa

The activities of the Evaluation Advisory Committee were curtailed because of financial limitations experienced by the IACP. However, individual members of the committee provided professional assistance to the IACP evaluation staff. Additional assistance was also provided by staff associated with the Evaluation Center at The Ohio State University.

IACP Evaluation Staff

Project evaluation was conducted by the IACP staff and coordinated by one of the Assistant Directors. Doctoral students majoring in industrial technology education with minor areas of study in evaluation and research methodology were employed as research associates to assist with evaluation tasks. Several of these research associates wrote dissertations that contributed to the development of the data reported in this document.

The evaluation staff developed strategy, techniques, and instruments to collect and analyze evaluative data. This document contains only a representative sampling of their products.

Limitations and Constraints

The evaluation strategy had the following major limitations and constraints:

1. Knowledge - based upon the available limited information
2. Ability - based upon the ability of the personnel involved
3. Cost - based upon the funds made available
4. Time - limited to the allotted time period
5. Staff - availability of professional personnel

Establishment of Field Evaluation Centers

The Field Evaluation Centers were created for the purpose of field testing and evaluating the total IACP instructional system in the public schools. Historically, little effort has been devoted to extensive field testing, evaluating, and revising of instructional materials and teaching practices in industrial arts education. Therefore, the utilization of evaluation centers was an innovative practice and provided the

IACP staff with a national laboratory where the efficacy of the teaching-learning system could be assessed. Information relative to the efficiency and effectiveness of the program was prepared by teachers, students, supervisors, and other related staff and was fed back to project decision makers who were responsible for program modification.

The Field Evaluation Center concept was initially conceived as being developed progressively. In 1967-1968, the first three centers were established. The following year, 1968-1969, a second group of three centers were selected. Originally, nine Field Evaluation Centers were proposed for the year 1969-1970. However, the last three centers were not developed for two major reasons. First, the available headquarters staff was having enough difficulty in processing the great bulk of material already being received from the existing centers. The review and summarization of feedback and the recommendations prepared by the evaluation staff were extremely time consuming, although essential to the improvement of the instructional program and the success of the project. The second major problem that restricted the expansion to three additional Field Evaluation Centers was the limited budget allotment caused by funding cutbacks. Nevertheless, based upon the experience of the first two years, it was felt that adequate feedback was being provided from the existing centers to meet the project goals, and there was no need to implement three additional evaluation centers.

In April, 1967, three geographical areas were selected to participate as Field Evaluation Centers for the IACP. These areas -- Cincinnati, Ohio; Dade County, Florida; and Trenton, New Jersey -- were selected because of personal contacts with people who (1) knew the purposes of the IACP; (2) generally agreed with the intended purpose of the project; and (3) were in leadership positions and could work well with their local school systems. Geographic dispersion of the centers was also an important factor in their selection.

The following year, schools in three additional cities were invited to participate as Field Evaluation Centers for IACP. Long Beach, California was contacted as a West Coast site because of previous professional association with the industrial education consultant of the Long Beach Unified School District. Austin, Texas was identified as a cooperative school system by a recent Ohio State University graduate employed at Texas A&M University, and fulfilled a need for a mid-southern regional center. Chicago-Evanston, Illinois was extended an invitation to participate in the program because it was a major midwestern metropolitan area. Chicago, in particular, was selected because of the variety of problems that are prevalent in an urban school system. These additional school systems provided a broader geographic spread of test centers and extended the sociocultural enrollment in the IACP. Location of the Field Evaluation Centers is shown in Figure 13.

The major purpose of the establishment of the Field Evaluation Centers was for testing, feedback, evaluation, and revision of instructional material. Another purpose involved the initial phases of dissemination -- getting people acquainted with the IACP across the country rather than limiting the project to the Columbus, Ohio area. Even though testing, feedback, evaluation, and revision were considered to be of greater importance than the dissemination activities of the program, both goals were considered important and mutually beneficial.

Most centers offered both "conventional" and IACP courses in their junior high schools. This arrangement provided the staff and visitors with an opportunity to see both programs in operation under similar conditions. Teachers and administrators were primarily selected on the basis of their interest and willingness to teach the new program and their desire to help implement and evaluate innovation in industrial arts education.

<u>Field Evaluation Center Personnel and Responsibilities</u>

Each field center consisted of a director and eight teachers. Four teachers taught construction and four taught manufacturing (Figure 14). A "head teacher" coordinated each group of four. The director coordinated all the center activities and was the liaison person with the headquarters staff. Even though the original intent of the project was to have only teacher educators serve as field center directors, in actual practice both city supervisors of industrial arts and industrial arts faculty members at local colleges and universities served in this capacity. The city supervisors, because of their direct line of communication and full-time involvement with the local schools, had fewer difficulties in coordinating activities and in coping with internal problems, such as budgeting, program expansion, working with school district personnel and procedures, coordinating and obtaining supplies, and distributing materials.

All IACP teachers came to the project from conventional industrial arts teacher education programs. However, several men were first-year teachers and had never taught conventional industrial arts except during student teaching. At the conclusion of the project, the teaching experience of the IACP field evaluation school teachers varied from

FIELD EVALUATION CENTERS 1967 - 1971

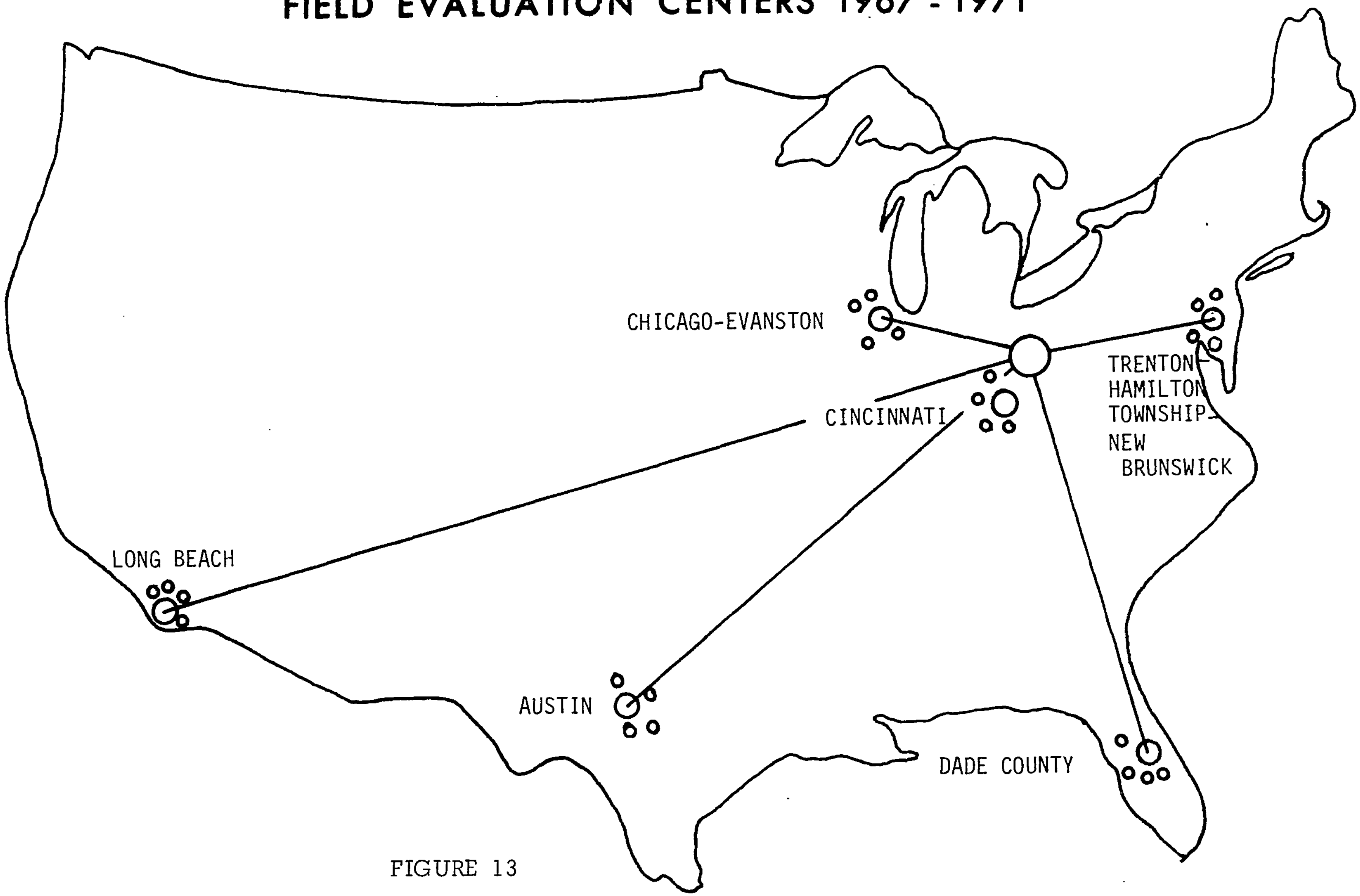
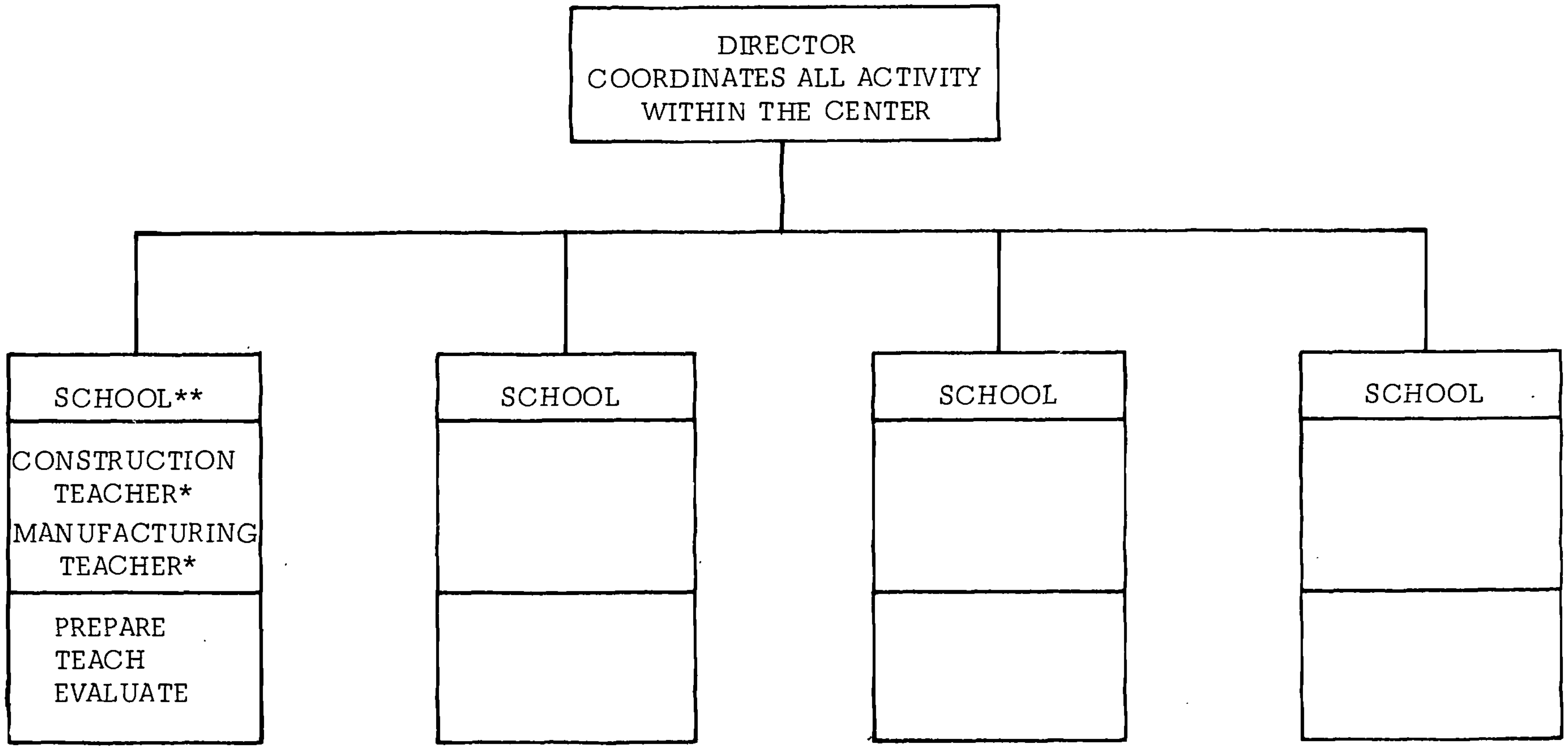


FIGURE 13

ORGANIZATION OF A
FIELD EVALUATION CENTER



* HEAD TEACHERS - HANDLE ALL FEEDBACK WITHIN THE CENTER

** SCHOOLS ARE WITHIN A 50-MILE RADIUS

FIGURE 14

3 to 27 years. In addition, many of these teachers had worked in industry -- some for as long as 9 years. The age of IACP teachers in the participating schools of the six Field Evaluation Centers ranged from 23 to 57 years; all had their bachelor's degree and 51 percent of the teachers had a master's degree.

Field center directors, with industrial arts backgrounds similar to those of most teachers, had teaching experience which ranged from 7 to 24 years, at the conclusion of the project. Some in this group had as many as 10 years of industrially-related experiences. As the IACP materials evolved into a commercial form, four of the six Field Evaluation Center directors had doctor's degrees, one had a master's degree, and one had a bachelor's degree. Data relating to Field Evaluation Center personnel are shown in Tables 5 and 6.

The responsibilities of Field Evaluation Center personnel were delineated as follows:

Field Evaluation Center Directors

1. Assisted in establishing Field Evaluation Centers.
2. Participated in the field staff preparation program.
3. Coordinated all Field Evaluation Center activities.
4. Established and maintained a local public relations program.
5. Assisted head teachers in planning and conducting weekly seminars.
6. Attended weekly seminars.
7. Maintained liaison with IACP headquarters.
8. Assisted in planning and conducting in-center programs, e.g., orientation, teacher preparation, and staff visitations.
9. Established and maintained liaison with industries and industry-related organizations.
10. Established a materials-ordering system.
11. Assisted teachers in scheduling and materials ordering.
12. Worked with school administrators in solving operational and financial problems.
13. Routinely visited the schools and assisted teachers in every way possible.
14. Helped prepare final report of project to USOE.

Head Teachers

1. Planned and conducted weekly seminars.
2. Collected all evaluative feedback and sent it to IACP headquarters.

FIELD EVALUATION CENTER PERSONNEL
EDUCATIONAL BACKGROUND

DEGREE	TEACHERS	DIRECTORS
BACHELOR'S	23	1
MASTER'S	24	1
DOCTOR'S		4

TABLE 5

FIELD EVALUATION CENTER PERSONNEL
TEACHING EXPERIENCE

PERSONNEL	YEARS EXPERIENCE					
	0-5	6-10	11-15	16-20	21-25	25-30
CONSTRUCTION TEACHERS	7	8	2	4	3	
MANUFACTURING TEACHERS	8	5	4	2	3	1
DIRECTORS	1	1	1	3	1	

TABLE 6

3. Wrote summaries of the weekly meetings and sent them to IACP headquarters.
4. Assisted the other teachers in scheduling and materials-ordering.
5. Assisted the Field Evaluation Center director in establishing a materials-ordering system.
6. Performed all of the duties listed under "teachers."

Teachers

1. Participated in the field staff preparation program.
2. Planned for and made adjustments to laboratories as required.
3. Established and maintained an appropriate classroom atmosphere.
4. Planned so as to be able to meet the IACP schedule.
5. Prepared to teach classes daily.
6. Ordered tools, materials, and supplies well in advance of the date required.
7. Conducted classes daily.
8. Evaluated all materials daily, by completing feedback forms and making "marked" copy.
9. Participated in the weekly seminars.
10. Handled materials from IACP headquarters (test materials, books, instructional aids, etc.)
11. Planned and conducted a public relations program for the school.

Teacher Preparation Conference

All teachers in the Field Evaluation Centers received special training at Ohio State prior to the utilization of the newly developed materials. This was necessary because industrial arts teachers usually do not learn how to teach construction and manufacturing in existing teacher preparation programs, nor do they learn how to evaluate curriculum innovations. Because teachers were asked to perform many new tasks, the teacher preparation program was extremely important.

The teacher preparation program was initiated in the spring of the school year preceding the installation of the IACP courses and was a continual process throughout the field testing program. The first contact was a two-day orientation session in the Field Evaluation Center. This first meeting was a seminar covering the rationale and structure of industrial technology as a body of knowledge and a brief overview of the two courses, "The World of Construction" and "The World of Manufacturing." The teachers were given written materials to study prior to the summer preparation program.

In each Field Evaluation Center, one construction teacher and one manufacturing teacher were selected to serve as head teachers. These individuals, along with the field center directors, spent eight weeks in Columbus working as full-time IACP staff members. During the first six weeks of this time, they became deeply involved in instructional materials development and began to detail the two-week program for the preparation of the other teachers.

All of the field staff members, including field center directors and teachers, participated in the two-week teacher preparation program. The summer program allowed field staff members to discuss the rationale and structure with headquarters staff members; read, review and discuss course strategies and content; watch demonstrations of and practice technical and methodological skills required to teach the course (concrete work, and role-playing, for example); discuss expectations for and techniques to be used in the evaluation program; simulate a routine week; and discuss the handling of administrative details.

A major purpose of the field center director was to organize and establish the weekly meetings of teachers in the Field Evaluation Center, after the teachers returned to their schools. In the main, training has been a major function of these weekly meetings, in addition to evaluation. Teachers were required to think ahead, prepare for the next week, deal with questions of methodology, with questions pertaining to procurement, and to resolve other problems to make the teacher feel sufficiently prepared and ready to teach the IACP materials. Therefore, the field center director and teachers were involved in continuous inservice training sessions during their weekly meetings.

Mid-year evaluation conferences were held for two purposes; first, to provide a summary of feedback from the first semester and review recommended changes; and second, to give an orientation or overview of the content for the approaching second semester. Usually, only the head teachers and directors were involved in these mid-year conferences. However, other selected teachers were occasionally asked to attend conferences to help with the evaluation process. This provided head teachers and directors with an overview of training, and enabled them to return to their centers to direct weekly meetings and perform inservice training with their colleagues.

Financing of these teacher preparation conferences was covered by the IACP budget. Travel and living expenses were provided for all of the participating teachers. In the field center, mileage was financed for the field center directors and participating teachers to attend the weekly meetings, throughout the school year. Also, teachers were encouraged to attend and participate in many professional and civic activities and functions that related to the Industrial Arts Curriculum Project.

Utilization of the Field Evaluation Centers

The Field Evaluation Centers, field center directors, and teachers were used to provide real-life contact with schools and students and to determine how the instructional materials and teaching strategy were working. The use of these centers involved the teaching of the program, the evaluation of materials each day (what worked and what did not work), and the summarization of a week's activities in weekly meetings. Each teacher completed daily feedback forms and "marked" copy. The head teacher directed the weekly meetings and summarized each teacher's daily notes, feedback forms, and marked copy, and sent these summarizations to the IACP headquarters. The Field Evaluation Center staff also attempted to resolve common problems and prepare for the next week's activities.

Field center personnel taught the instructional materials utilizing the prescribed teaching procedures; they evaluated them and provided suggested program revisions and ideas. In addition to teaching and evaluating the instructional package, directors, head teachers, and selected teachers assisted in creating and revising the instructional material during the summers in Columbus. To aid in the dissemination of the IACP program, another role of Field Evaluation Center personnel, particularly in the last two years of the project, was to interest community and professional groups in the IACP program by making presentations at local, state, and national meetings, schools, professional conferences, and to various interested groups. Experienced teachers later served on teacher education staffs at colleges and universities assisting with the preparation of IACP teachers. The major purpose of the Field Evaluation Center teachers, however, was to teach, test, and revise the instructional materials and teaching strategy.

Visitation of Staff to Field Evaluation Centers

The IACP plan called for at least four visitations a year to every Field Evaluation Center by a member of the headquarters staff. One of the primary purposes of this activity was to visit with school administrators, such as superintendents, principals, and curriculum directors, to keep them informed of IACP activities and to help them feel a part of this innovative program. These visitations also permitted personal assessments of the program and the collection of information from classroom observations. Most of the evaluation information generated in the classroom, however, was transmitted through the formal feedback system. The visitations helped to develop and maintain a feeling of association with the cooperating school systems and colleges.

Even though each visitation was usually only two days in duration, the staff member visited each school within the center. During each visit, the staff member observed a weekly evaluation meeting; this was helpful in assessing the teachers' reactions to the instructional materials.

In many cases when a visitation was made, the headquarters staff member was requested to make formal presentations to other groups. Presentations were made to the curriculum staff of city-wide systems, to groups of college students, to local industrial organizations, and to many other interested groups. Many presentations were also made to superintendents of non-participating school systems and their administrative and teaching staffs during curriculum study meetings. Visitations were usually planned so that all of these related dissemination activities could be performed.

All members of the headquarters staff performed these visitations throughout the school year. Because of the work load of the project staff, each center was visited on the average of three times a year rather than four as had been proposed.

Students Enrolled in IACP

One of the tasks undertaken by the IACP evaluation staff was to obtain some indices concerning the students enrolled in the IACP program. After investigating several methods of accomplishing this task, a decision was made to concentrate on two indices: intelligence quotient and social position.

In order to show the relative position of IACP students with respect to mean intelligence quotient and social position, the same information was gathered from students in and around the Field Evaluation Centers that were enrolled in conventional junior high school industrial arts programs.

The information reported in this section was used as part of a comparative study of achievement of IACP students and conventional industrial arts students. The results of the study are reported in the following chapter of this report.

Intelligence Quotient Scores

Intelligence quotient scores were obtained for the purpose of determining the variation in ability level of students enrolled in the IACP program. 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 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 determining the variation in socioeconomic status of students enrolled in the IACP program. For this purpose, the Two Factor Index of Social Position developed by Hollingshead (1957) was utilized. In explanation of the scale, Hollingshead states:

> 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.

Occupational Scale

1. Higher executives of large concerns, proprietors, and major professionals.
2. Business managers, proprietors of medium-size businesses, and lesser professionals.
3. Administrative personnel, owners of small businesses, and minor professionals.
4. Clerical and sales workers, technicians, and owners of little businesses.
5. Skilled manual employees.
6. Machine operators and semiskilled employees.
7. Unskilled employees.

Educational Scale

1. Professional (M.A., M.Ed., Ph.D., Ed.D., M.D., LL.B., and the like).
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.

The scores of "Occupational" and "Educational" were weighted and combined for each student. For example, if the father of student A was a semiskilled machine operator and had 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:

Factor	Scale Score	Factor Weight	Score X Weight
Occupation	6	7	42
Education	4	4	16
Two Factor Index of Social Position			58

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

A Comparison of IACP Students with Conventional Industrial Arts Students

Table 7 illustrates the means and standard deviations of a stratified random sample of 600 that was drawn from students enrolled in the IACP and conventional industrial arts programs. The total sample mean of 101.06 for intelligence quotient and 44.58 for social position approached the standardized norms for both indices.

The variability of intelligence quotient for the total sample was 15.64 and for social position 17.86. The variability for the six groups did not appear to fluctuate greatly from that of the total sample. The standard deviations of the intelligence quotient for the groups had a range from 12.95 to 15.75. The variability for social position for the groups ranged from 14.25 to 19.55. It appears that the students enrolled in the IACP courses were representative of the normal population enrolled in junior high school.

Students enrolled in a second-year program of conventional industrial arts (Industrial Arts II) were markedly different. The mean intelligence quotient was low (91.68) and the social position was higher (55.72). The slightly lower intelligence quotient is in keeping with the stereotyped concept of elective industrial arts as a program for nonacademically successful students (Buffer, 1969, p. 221).

The mean scores of students enrolled in IACP in the Field Demonstration Centers were, on the other hand, higher than average. This might be accounted for by the fact that many school systems usually try innovative programs in progressive school settings with students that are more receptive to change.

Collection of Data

Type of Data

Most of the data collected pertained to the program and the instructional process and are summarized below.

Program:

1. Appropriateness of time allocations, including time for teacher preparation and evaluation

INTELLIGENCE QUOTIENTS AND SOCIAL POSITIONS
OF IACP & CONVENTIONAL IA STUDENTS

	Total Sample	IACP - Field Evaluation Centers		IACP -Field Demonstration Centers		Conventional Industrial Arts Programs	
		Construc-tion	Manufac-turing	Construc-tion	Manufac-turing	Industrial Arts I	Industrial Arts II
Intelligence Quotient Mean	101.06	98.58	102.74	108.93	105.29	100.71	91.68
Intelligence Quotient Standard Deviation	15.64	15.66	15.75	12.95	13.82	15.68	14.82
Social Position Mean	44.48	46.35	43.83	38.36	42.10	41.15	55.72
Social Position Standard Deviation	17.86	16.07	16.72	18.29	14.25	19.55	14.04
Number of Students	600	100	100	100	100	100	100

TABLE 7

2. Organizational and operational problems for teachers and the school
3. Omissions, inaccuracies, and irrelevancies
4. Teacher education
5. General program acceptance by colleagues, industrialists, and the community

Instructional Process:

1. Students' interest in concepts studied
2. Ability of student to participate satisfactorily in program requirements
3. Pupil growth -- cognitive, affective, and psychomotor
4. Students' level of interest, success, and involvement
5. Test data to assess the attainment of behavioral objectives

The above data were collected by written instruments, reports, interviews, and through conferences and committees. The written instruments were composed of achievement tests, comprehensive examinations, and questionnaires for students, teachers, administrators, parents, and industrialists. The reports included daily feedback forms, weekly reports, anecdotal reports, and marked copy from the Field Evaluation Centers. Interviews with the teachers and administrators provided additional feedback as did the mid-year and summer evaluation conferences.

Achievement Tests

The design of the IACP included the development and use of standardized tests for evaluation purposes. The evaluation yielded information about the effectiveness of the curriculum materials and the teaching techniques and the efficiency of student learning in the project. Clues to strengths and weaknesses were sought in the test data and were analyzed through research studies and discussions between the project staff members and teachers.

Nine achievement tests, to be administered about once every three weeks, and one comprehensive examination, to be administered at the end of the school year were developed for both "The World of Construction" and "The World of Manufacturing."

Test Development. Concurrently with the development of the achievement tests for "The World of Construction" and "The World of Manufacturing," a review of the literature was done to determine the ideal form for achievement tests. This information was then used as a referent in the initial construction and revision of the examinations.

In the review of literature, achievement tests were found to have the greatest positive influence on the teaching-learning process when they (1) accurately reflect major instructional objectives, (2) measure an adequate sample of desired learning outcomes, (3) are constructed to serve the purposes for which they will be used, and (4) are designed to yield reliable and valid scores (Peter, 1970, p.63). To be reliable, the test items should be neither too easy nor too difficult. An easy test discriminates at the lower end of the scale but bunches the top end, and is unsatisfactory for measuring most of the group. A difficult test allows a spread at the top end of the scale but bunches the bottom, and is unsatisfactory for most of the group (Cronbach, 1970, p. 164). As Lindnam (1967) points out: "The range of values of the discrimination index depends on the difficulty level of the items. Items with difficulty levels of zero or 1.00 always have discrimination indices of zero; they cannot possibly discriminate between pupils of good or poor achievement (p. 91)." Lindnam recommends that items which fall in the 40 to 60 percent difficulty range are the most discriminating (p. 91). This would tend to place both mean and median at the center of the test which is in agreement with Cronbach (1970) who said: "Tests yielding roughly normal distributions are preferred when it is necessary to distinguish (differences in achievement performance) all along the scale (p. 164)."

The length of the test must also be considered. A long test allows for a greater spread of scores and improves reliability. However, too long a test increases the fatigue of the student and takes the teacher longer to score and analyze. Too short a test does not provide the opportunity for a broad sampling of concepts. Also, as part of our evaluation, it was found that short tests of 25 items provided some classroom management problems. Thus a compromise was needed. Periodic achievement tests containing 35 items and a 50 question comprehensive test were developed and found to be of appropriate length for students and teachers.

In summary, an ideal achievement test should reflect the major instructional objectives, be long enough to comprise an adequate sampling of desired learning outcomes, and utilize items with a 40 to 60 percent difficulty index to provide discrimination and to group the mean and median at the center. In addition, test reliability levels (Kuder-Richardson 20 and 21) should be .70 or greater. The above criteria were used by the IACP when developing achievement tests.

Analyzing Test Data. The achievement test results were computer-analyzed (1) to determine if the program objectives were being met, (2) for the assessment evaluation of student achievement, and (3) for the purpose of revising the instructional materials and the testing instruments. The Ohio State University Center for Measurement and Evaluation and the Test Development Center analyzed the test data and provided a computer readout of descriptive data including measures of central tendency, reliability coefficients, item discrimination, power index, etc. These computer readouts were used, in part, when revising both the tests and the teaching-learning processes.

Table 8 shows a summary analysis of selected developmental forms of construction and manufacturing achievement tests administered as part of the field evaluation program. A sample of students was randomly selected from each school to complete each test using machine scorable answer keys.

Normative test data for The World of Construction Comprehensive Examination, fourth edition, are reported in Table 9. Summary statistics for The World of Manufacturing Comprehensive Examination, third edition, are reported in Table 10. The data for these instruments were collected as part of the final evaluation of the IACP and the results of this study are reported in the following chapter.

The World of Construction Comprehensive Achievement Test administered to 310 students produced a mean of 26.41, a median of 25, a range of 45 with no one getting 0 or 50, a standard deviation of 11.01, a Kuder-Richardson 20 reliability of 0.920, and a Kuder-Richardson 21 reliability of 0.916. The World of Manufacturing Comprehensive Achievement Test administered to 255 students produced a mean of 22.00, a median of 21, a range of 40 with no one getting 0 or 50, a standard deviation of 8.13, a Kuder-Richardson 20 reliability of 0.845 and a Kuder-Richardson 21 reliability of 0.830.

The periodic achievement tests and comprehensive examinations generally yielded a good spread of scores in each of the centers, and there was no concentration of scores at either end of the distributions. The mean scores were fairly close to the midpoint of the possible range of scores. Therefore, the tests were apparently appropriate in difficulty for the IACP students.

In general, the test results indicated that the pupils gained useful knowledge of basic principles of construction and manufacturing. The tests that were administered proved to be appropriate in difficulty for this group and served as an efficient measure of differential

SUMMARY ANALYSIS OF CONSTRUCTION AND MANUFACTURING ACHIEVEMENT TESTS

	Number Students	Number of Test Items	Average Mean Score	Average Reliability K-R 20	Average Reliability K-R 21
Construction Series					
Form 1	1115	35	16	.79	.77
Form 2	219	25	14.3	.78	.75
Comprehensive Test					
Form 2	1775	48	25.3	.89	.88
Form 4	310	50	26.4	.92	.92
Manufacturing Series					
Form 1	217	25	18.5	.84	.82
Form 2	154	35	18.5	.83	.80
Comprehensive Test					
Form 2	180	49	19.9	.64	.41
Form 3	255	50	22	.85	.83

TABLE 8

SUMMARY STATISTICS OF THE WORLD OF CONSTRUCTION
ACHIEVEMENT TEST COMPREHENSIVE EXAMINATION
FOURTH EDITION

Number of Items on Test	50.0
Number of Students in Sample	310.0
Median	25.0
Mode	13.0
Mean	26.41
Standard Deviation	11.01
Skewness	0.17
Kurtosis	-1.04
Range	41.0
Maximum	45.0
Minimum	4.0
Reliability Estimates	
Kuder-Richardson formula 20	0.920
Kuder-Richardson formula 21	0.916
Mean Item Difficulty	0.472
Mean Item Discrimination	0.550

TABLE 9

SUMMARY STATISTICS FOR THE WORLD OF MANUFACTURING ACHIEVEMENT TEST COMPREHENSIVE EXAMINATION THIRD EDITION

Number of Items on Test	50.0
Number of Students in Sample	255.0
Median	21.0
Mode	29.0
Mean	22.0
Standard Deviation	8.13
Skewness	0.14
Kurtosis	-0.67
Range	40.0
Maximum	42.0
Minimum	2.0
Reliability Estimates	
Kuder-Richardson formula 20	0.845
Kuder-Richardson formula 21	0.830
Mean Item Difficulty	0.560
Mean Item Discrimination	0.390

TABLE 10

success in learning the subject matter.

In the opinion of the IACP evaluation staff and field center personnel who worked on the development of these achievement tests and analyzed the results, evaluation techniques of this nature provided valuable information about teaching and learning accomplishments in the Industrial Arts Curriculum Project.

Reports

Completed daily feedback forms, weekly reports, marked copy, and interview feedback were also collected, codified, synthesized, and utilized by the IACP staff in revising materials and procedures. Examples are presented in Appendices A and B.

Questionnaires

A series of questionnaires was developed to determine the appropriateness of the instructional materials and procedures and their acceptance as perceived by students, teachers, parents, administrators, and industrialists. Some representative examples of the questionnaires are included later in this report together with a synthesis and analysis of the data collected.

Evaluation Conferences

There were eight evaluation and revision conferences conducted from January, 1968 to August, 1971. These conferences were held at the following times in Columbus, Ohio:

1968: Mid-Year Evaluation Conference, January 15-18; Summer Revision Conference, July 1-August 23.

1969: Mid-Year Evaluation Conference, January 22-25; Summer Revision Conference, July 1-August 8.

1970: Mid-Year Evaluation Conference, February 28-March 6; Summer Revision Conference, June 29-August 12.

1971: Mid-Year Evaluation Conferences, January 14-16 and January 21-23; Summer Evaluation Conference, June 28-August 6.

The purposes of these conferences centered on:

1. Evaluation and revision of instructional content and sequence.

2. An examination of new instructional materials inputs for both manufacturing and construction courses.

3. A general evaluation of the instructional system. More specifically, this item dealt with the analysis of problems, strengths, and strategies that relate to the appropriateness of laboratory activities, reading assignments, teacher preparation, and laboratory facilities and equipment.

4. A general evaluation of the IACP.

A description of the activities and accomplishments of the eight evaluation conferences is included in Appendix C.

Utilization of Data

Pilot Studies

The gap between educational theory and educational practice was of particular concern to curriculum developers associated with the Industrial Arts Curriculum Project. Essentially, their task was to eliminate or minimize this gap by inventing, designing, engineering, and constructing an instructional package based upon the knowledge advanced in A Rationale and Structure for Industrial Arts Subject Matter (Towers, Lux, and Ray, 1966). In developing this instructional package, the attention of the curriculum development staff also had to be focused on the objectives of industrial arts as well as on the critical requirement of feasibility. The instructional package had to work in the typical junior high school program. The requirement of feasibility demanded that the newly developed instructional package be field tested. The process of field testing would provide curriculum developers with valuable feedback regarding how well the instructional package was working, some of the problems that existed, and suggested solutions to these problems. Of paramount importance to the total project effort, was the collection and utilization of feedback for improving the instructional package.

The intent of this section of the evaluation report is to detail how the feedback process was originally planned, organized, and controlled. In addition, attention will also be directed to the methods used in implementing the suggestions and information contained in the feedback reports.

Interchangeability of Parts. Feedback and its subsequent usage for revising instructional materials in IACP first occurred in connection with the Cincinnati Pilot Study. The purpose of the study which began in September, 1965 and ended in January, 1966, was to establish a set of procedures for the future development of instructional material. Essentially, an instructional package dealing with the concept of interchangeability of parts was developed and field tested by the IACP curriculum materials specialist, and later taught by the Cincinnati industrial arts supervisor and eight teachers to 465 pupils in the Cincinnati Public Schools. The instructional package consisted of a text, student lab manual, teacher's guide, and achievement tests. The total instructional time used (classroom and laboratory) was three fifty-five minute periods for each class.

A PERT network with activity descriptions was developed to facilitate management of the pilot studies. In one respect, feedback occurred after every activity listed in the PERT network. Feedback in this case consisted of a description of how the task was accomplished, the problems encountered, and recommendations for accomplishing the task in future curriculum development efforts. As it relates to the actual instructional package, feedback was first obtained as a result of the unit being taught by Dr. A. Dean Hauenstein and Dr. Henry J. Sredl. An example of the feedback obtained appears below:

Event	Activity	Date	Personnel	Time Est.Hrs.
27-30	Teaching & Evaluation	11-16	Hauenstein	6-10
		11-18	Sredl	6-10

NOTE: Sredl taught mostly by lecture, used some questions and discussion, was rushed for time and did not complete two full lab activities.

Hauenstein taught by question-response, was rushed for time but covered all lab activities. Lesson was more structured.

RECOMMENDATIONS: A definite classroom area and definite lab area was suggested. Longer teaching time, less material, or less depth appeared desirable. Revise test -- was too difficult. Revise text subtitles to relate to questions. The revised lab activities were adequate. Revise supplementary text activities for more interest.

NOTE: Despite an anticipation of something new, there was a general lack of student interest.

From their initial teaching trial, Hauenstein and Sredl obtained important information which led to the first revision of the instructional package dealing with the concept of interchangeability of parts. Following this revision, the instructional package was tested by the eight classroom teachers in the Cincinnati Public Schools. These eight teachers were then asked to complete evaluation forms dealing with each part of the instructional package. The results of their evaluation served as additional feedback for revision purposes.

The pilot study was a small-scale effort to determine some of the problems encountered in developing an instructional package for use in the junior high school. This initial curriculum development experiencegave the project personnel valuable feedback which was used in developing current courses in construction and manufacturing technology.

The results of the pilot study thus allowed the project staff to answer a number of important questions. With their new information, they were able to plan their future curriculum development efforts on a much larger scale.

Construction: Setting Foundations. After completing the initial Cincinnati Pilot Study, the curriculum materials specialist prepared one more instructional unit dealing with the construction of foundations for various structures, e.g., buildings, towers, and dams. There were two major purposes behind this second effort of curriculum development. First, the project staff was anxious to try out some of the suggestions obtained from the feedback associated with the first pilot project. Second, there was now an adequate number of trained personnel available to more efficiently produce the instructional package. The mechanical procedures of typing, illustrating, proofreading, and duplication could be performed in a more efficient manner. With a smoothly functioning team, more accurate estimates could be made of the time needed to prepare instructional materials in the future.

The instructional unit developed was entitled "Setting Foundations." The unit format was similar to the unit on interchangeability of parts in that it consisted of a text, teacher's guide, laboratory manual, and achievement test. The primary differences were that setting foundations dealt with construction technology rather than manufacturing technology, and the time required to complete the activity was only one class session.

The instructional unit was again field tested by the curriculum materials specialist and six teachers in the Cincinnati Public Schools. Feedback from the teachers helped refine the development process and provided additional information relating to efficient methods of collecting feedback.

Modifying the Instructional Package

This section is concerned with the utilization of feedback to improve instructional objectives, procedures, and materials. It includes an analysis of data from achievement tests, dissertations and theses, questionnaires, interviews, and feedback reports.

Revision of IACP Objectives. The overall objectives as listed in the rationale and structure for each program remained basically the same. Behavioral performance objectives for daily lessons were modified when a change in activity was encountered. The concept used as a referent to determine objectives did not change, but the method and materials used in teaching the concepts and accomplishing the objective were altered in several cases.

Revision of Procedures and Materials. The project staff and the IACP field personnel adjusted procedures for ease of performance and accomplishment. Some steps in the production activity of manufacturing required a more efficient arrangement of facilities or tools; feedback suggested changes. These changes were tried in actual laboratory settings by research associates and the IACP teachers during the Summer Revision Conferences. Data from feedback also suggested product changes for various reasons; the most common were cost and student interest.

Feedback from IACP teachers and staff on revision of software was considerable. Changes of type style, size of type, and number and quality of illustrations helped improve readability of the copy. Clarity of format and content was improved through greater distinction between lesson-heading styles (compare 1st edition with 2nd edition), the use of cognitive maps (none in 1st edition), and the use of color. The reduction of the readability of the instructional material to the 7th and 8th grade levels greatly improved the students' comprehension of content. Before the printing of the commercial edition, various shades of gray, or line patterns, were used in illustrations. Photographs were not used in the 1st edition but were incorporated in subsequent editions. Continual improvement in type face, illustration, format, length of reading, and subject matter can be noted by reviewing the first, third, and commercial edition materials. An example of one unit, "Soil Testing," is outlined in Figure 15 while detailed comparisons are found in Appendix D.

Improvement in the style of headings and boldness of subtitles improved the clarity and purpose of the unit. Some subtitles were dropped, and other subtitles and new concepts were introduced in the readings. Even with a reduction in subtitles and less reading material, most units proved to be too long for most children and had to be reduced. Conceptual maps incorporated in the third and commercial editions assisted in shortening the readings and made the content more meaningful.

Improved illustrations, format, and type face; use of color; and an appropriate readability level helped to greatly improve the commercial edition of "The World of Construction." The publisher incorporated these same techniques and practices when producing the commercial edition of "The World of Manufacturing."

Summary

This chapter reviewed the rationale and strategy used to evaluate the IACP. Formative, summative, and intraschool evaluation data were collected to improve the instructional materials and project activities. A review and summary of the findings collected by IACP headquarters staff and evaluation and demonstration center personnel are reported in the following chapter.

CONTENTS OF THREE VERSIONS OF THE UNIT "SOIL TESTING" IN THE TEXTBOOK, THE WORLD OF CONSTRUCTION

	First Edition	Third Edition	Commercial Edition
(Title)	The Earth Below	Soil Testing	Soil Testing
(Sub-titles)	The Earth Below	The Earth's Crust	The Earth's Crust
	Who Does Soil Analysis ?	Soil Characteristics	Soil Characteristics
	Soil Analysis	Soil Analysis	Soil Analysis
	Kinds of Soil	Soil and Construction	Soil and Construction
	Ground Water	Soil Engineering	Soil Engineering
	Soil Characteristics	Summary	Summary
	Soils and Construction		
	Soil Engineering		
	Summary		

FIGURE 15

CHAPTER IV

SUMMARY AND ANALYSIS OF EVALUATION DATA

The purpose of this chapter is to present a summary and analysis of the evaluation data collected regarding the efficacy of the IACP. Information regarding project management and student achievement, and opinions regarding the validity, appropriateness, and acceptance of the instructional system are reported. Conclusions and recommendations based on the findings of this evaluation are presented in Chapter VI.

Analysis of Project Management

The activities, responsibilities, and professional experiences of the administrative staff are described partially elsewhere in this report. However, it was thought that the project staff should share with the profession a description and analysis of some of the management tasks and problems encountered during the project. This section has been prepared from the frame of reference of college professors who were not trained as business managers, but found it necessary to administer a multi-million dollar operation involving institutions of higher learning, numerous educational systems and agencies, and personnel located throughout the United States.

At the conclusion of 75 months of project activities, it seems useful to stand back to reflect upon and evaluate the management of this research, development, and dissemination effort. Management is often defined as "getting work done through other people." Without question, the work of the Industrial Arts Curriculum Project would not have been successful without the combined accomplishments of hundreds of headquarters staff, field staff, and support personnel of business, industry, labor, professional associations, and colleges and universities.

In the main, however, the functions of planning, organizing, and controlling the project have been the responsibilities of a few key persons at headquarters and in the field. The responsibilities have included general project administration (co-directors); evaluation, instructional materials development, and dissemination (assistant directors); and Field Evaluation Centers (field directors). A more detailed description of project management has been recorded in 22 quarterly reports and one final report (of first phase) on file with the United States Office of Education.

This analysis of project management will be treated in four sections: (1) financial resources, (2) human resources, (3) copyright arrangements and (4) effects on The Ohio State University.

Management of Financial Resources

Over the 75-month duration of the project, there have been ten separate contracts, grants, or amendments negotiated between the United States Office of Education (USOE) and The Ohio State University Research Foundation (OSURF). Technical assistance has been provided to the project staff by OSURF personnel in preparing initial budget estimates and in preparing proposal documents. Often budgets would need to be revised to meet the requirements of the sponsor (USOE).

In retrospect, the process of securing funds for project continuation has been a hectic one. Doubt, uncertainty, and sheer fear prevailed on several occasions when commitments had to be made to headquarters and field personnel prior to final approval of funding. Several times during the project, The Ohio State University had expended thousands of dollars on its own in anticipation of final approval of funds. Had such approval not been gained, the University would have lost significant amounts of money.

The frustrating process described above is one that should be thoroughly studied by funding agencies, such as USOE, and university personnel, such as professors, so that future R, D, E, and D projects may be administered more smoothly. Although it is recognized that the sponsor should have review powers and quality control over the work of the contractors, it is certainly desirable to operate with longer lead-time on project approval periods, with assured funding. Present operations of USOE do not provide for such flexibility, unfortunately. Proposal deadlines often are announced only days or weeks before the due dates. Approvals often come too late to provide adequate planning and organizing of facilities and personnel.

In addition to USOE funds, The Ohio State University and its College of Education have been involved in cost sharing in an amount which has approached ten percent of total sponsor funds. During some funding periods it was nearly twenty percent. This has been a significant commitment on the part of the University, and it should not go unnoticed.

Other financial resources, detailed elsewhere in this report, have been secured and administered through OSURF and The Ohio State University Development Fund. These monies, received from associations and industry-related groups, have helped to assure continuity of project operations and, in one year, prevented having to cut back field evaluation commitments and operations.

The monies received by The Ohio State University have been monitored by personnel in the Project Administration Section of OSURF. All expenditures of funds have been initiated and approved by the Project Director (Edward R. Towers - 1965-1968) or the Project Co-Directors (Donald G. Lux and Willis E. Ray - 1969-1971). Requisitions have been initiated by project staff and have been processed through OSURF. All business procedures (purchase orders, etc.) have been handled by OSURF staff. Accounting services of OSURF have provided detailed monthly statements of account for the project. Complete business records have been kept in anticipation of the usual United States General Accounting Office (GAO) audit.

The services described above have been invaluable to the professor-type who would be unable to perform, let alone understand, the intricacies of such procedures. It has been difficult enough just to estimate remaining balances based upon the monthly statements of account.

In summary, regarding financial management, there have been many rough spots over the past few years. Regardless of such difficulties, the technical staff of USOE and OSURF have been most helpful and understanding. Without their assistance, the project could not have survived.

Management of Human Resources

During the period of the project, there was a major change of administration. When the Project Director decided, in the autumn of 1968, not to pursue additional funding from USOE, the Project Associate Directors were authorized by the Dean of the College of Education, the Vice President for Academic Affairs, and the Executive Director of OSURF to take over fiscal management of the project (effective January, 1969) and seek continuing support from USOE. This action was taken, and financial resources were obtained to complete the R, D, E, and D plan as outlined in initial proposals. Edward R. Towers, the former Project Director, resigned from The Ohio State University in September, 1969, to enter private enterprise.

Other key personnel were lost to the project over the years. At the end of the first twelve months of work, Jacob Stern, one of the four original Principal Investigators, resigned from the University of Illinois to accept a position at another institution. Robert E. Blum, Evaluation

Specialist, also resigned from The Ohio State University, in September, 1969, to enter private business. John D. Jenkins, Assistant Director for Dissemination, accepted a position with another institution and left the project in August, 1970.

For health reasons, the first director of the Dade County, Florida, Field Evaluation Center resigned his position. The director of the Trenton-Hamilton Township-New Brunswick, New Jersey, Field Evaluation Center accepted a position at another institution. For various reasons, ten classroom teachers changed positions during the four years of field testing in the schools.

All things considered, the key headquarters and field staff and the teaching staff remained remarkably well intact for the duration of the project. This speaks well for a group of persons in a profession with increasing mobility.

Another major component of human resources has been the more than 50 research associates employed by the project. Although their major mission was the attainment of graduate degrees, they served with distinction. In actuality, there have been about three generations of RA's who have moved in and out of the project during the past six years. This has posed the normal problems of orientation and training of this significant project resource.

Outstanding in their contribution have been the scores of consultants, advisers, writers, and reviewers from business, industry, and labor. In most instances these persons were employed for short periods of time on specific assignments. In other instances, their contributions were donated at no cost to the project. One reason for the success the project has enjoyed has been the substantive inputs of these persons. Without them, the instructional material would have been less accurate and authentic.

Last, but not least, the clerical, editorial, and art staff have been essential elements in this team effort. These support personnel have been loyal and hard-working over the years. Although there has been some continuing turnover in these positions, this has not adversely affected project work.

Copyright Arrangements

In March, 1968, the USOE published in the Federal Register a set of copyright guidelines for materials developed under USOE contracts and grants. In the autumn of 1968, the Project Associate Directors sought and secured copyright on the developmental materials, as provided in these guidelines. The Office of Education recognized that there may be occasions where it would be in the public interest to prevent curriculum and other materials from falling prematurely into the public domain while they were being developed, field tested, and evaluated. Subsequent to the autumn of 1968, each developmental edition of The World of Construction and The World of Manufacturing has been copyrighted.

In addition, the project staff took action to have the commercial edition of both programs copyrighted under other provisions of the USOE guidelines. Each set of materials has been copyrighted by The Ohio State University Research Foundation on a "limited" basis for five years. All of the procedures outlined in the USOE guidelines were followed in the search for and the selection of a commercial "producer" of the instructional materials. Under this limited copyright agreement, operating under a revised set of USOE guidelines (effective June, 1970), all author royalties are returned by the producer (publisher) to the OSU Research Foundation. One-half of these royalties are transmitted to USOE for deposit in the United States Treasury General Fund. The other fifty percent of the royalty monies are held in an account with the OSU Research Foundation to promote further research and development and teacher education related to the IACP.

Effects on The Ohio State University

There have been many positive outcomes from having the project headquartered on the campus of The Ohio State University. These will not be extolled here. There have been, however, certain disadvantages that have been experienced that should be touched upon for the record.

Because most of the permanent faculty have devoted large portions of their time in project activities, certain aspects of the instructional and service programs have suffered. Although the undergraduate program has been revised to reflect project ideas, the industrial technology education majors have had limited direct personal and professional contact with IACP staff for the past six years.

Also of import has been the effect upon the laboratory facilities of the Faculty of Industrial Technology Education. For the past four years, tools, machines, and equipment have been used to fabricate apparatus and teaching aids for usein project schools. Absolutely no monies have been received to replace or repair equipment that has been worn or damaged from such use. Many projects receive money for equipment for project-related use, but this has not been provided through USOE.

Although many benefits have accrued to the project staff, there have been some changes in life style that have not been positive. These involve the professional as well as home and family life. Briefly, long and late hours, extended work weeks, and extended travel time have often interfered with teaching and home responsibilities. During one particularly hectic period, as we doubled the work load by adding the manufacturing output to the construction output, the co-directors and assistant director for materials development worked seven days per week for seven consecutive weeks. These disadvantages must be taken into consideration, together with professional satisfaction, on the final balance sheet.

Pretest, Posttest Gains of Achievement Test Scores of IACP Students

A pretest, posttest study was conducted to determine the amount of growth in student achievement on the IACP construction test and on the manufacturing test. The first study was conducted in the 1967-68 school year with construction students. The study was partially replicated during the 1968-69 school year with manufacturing students. Both studies involved well over 1000 IACP students enrolled in the Field Evaluation Centers.

The comprehensive achievement tests were administered to construction and manufacturing students during the first week of the course and again (about 36 weeks later) at the end of the school year. The data clearly indicated that statistically significant differences (beyond the .01 level) existed for both construction and manufacturing between the mean scores with the posttest being greater (11 points). (See Tables 11 and 12.) Similar pretest-posttest studies were not conducted for the 1969-70 or 1970-71 years since the baseline data were established for pretest scores in previous years.

CONSTRUCTION COMPREHENSIVE TEST 1967-1968 DATA

Characteristics	Pretest	Posttest
Number of Students	1024	1775
Number of Items	50	48
Mean	14.21	25.38
S.D.	5.72	9.44
Median	13.84	26.0
K-R 20 Reliability	.72	.90
K-R 21 Reliability	.70	.88

TABLE 11

MANUFACTURING COMPREHENSIVE TEST 1968-1969 DATA

Characteristics	Pretest	Posttest
Number of Students	1015	1828
Number of Items	50	50
Mean	15.84	26.43
S.D.	5.69	9.55
Median	15.20	27
K-R 20 Reliability	.70	.90
K-R 21 Reliability	.68	.88

TABLE 12

Comparative Evaluations of Student Achievement: Pilot Studies

One area of emphasis in the evaluation efforts of the IACP team dealt with comparing the achievement of students enrolled in the IACP program with that of students enrolled in conventional industrial arts programs. The cognitive, affective, and psychomotor domains of knowledge were investigated by IACP research associates. Initially, three studies were completed. Each of these studies focused on one of the domains of knowledge and was conducted using small samples of students. These studies did provide the basis for a more comprehensive comparative study of student achievement. Abstracts of other doctoral dissertations completed by IACP research associates that relate to the project are included in Appendix E of this report.

Comparison of Psychomotor Achievement

The first of these early works was conducted by Vincent C. D'Ambrosio (1969). His major purpose was to compare the psychomotor ability in selected manipulative activities of students completing "The World of Construction" course.

The study was completed using an ex post facto research design. The experimental group participated in "The World of Construction" for one period a day, five days a week, for 39 weeks. The other group received instruction in conventional industrial arts with 13 weeks in each of the areas of woods, metals, and drafting for the same number of periods. To offset extraneous variables, a third group (Group C) with no industrial arts experience, was used as a control.

Seven objectives were established to guide the development of a manipulative-performance achievement test, to conduct the testing phase, and for analysis of the data obtained in the study. The manipulative activities chosen for this study were limited to five hand tool operations common to both the conventional course and "The World of Construction." These activities were:

Cutting a board to length
Planing a board to width
Laying out and boring a hole
Laying out and cutting a curve

To evaluate the treatment received by each group, a performance test was next developed involving the aforementioned manipulative skills. The students' scores on this test were analyzed to determine if there were any significant differences among the groups on performance achievement of the common manipulative skills.

The findings of D'Ambrosio's study were:

1. An analysis was performed to determine which industrial arts course had the greatest effect on achievement attained on performance associated with overall mean achievement, mean achievement of each operation, and mean achievement of each measurable performance criterion. This analysis yielded the following results:
   a) No significant difference between the groups on overall mean achievement.
   b) No significant difference between the groups on mean achievement for each measurable performance criterion, with two exceptions: Criterion 5 (location of hole to surface A--1/4" hole) and Criterion 7 (squareness of hole to surface C--1/4" hole).

2. An analysis of the data was performed to determine the differences in performance between the two industrial arts groups and the non-industrial arts students (Group C). This analysis yielded the following results:
   a) Both industrial arts groups performed significantly better than Group C on overall mean achievement.
   b) Both industrial arts groups performed significantly better than Group C on Operation B (plane the board to the required width); the traditional seventh grade industrial arts groups also performed significantly better than Group C on Operation C (lay out and drill a 1/4" hole).
   c) Both industrial arts groups performed significantly better than:
      Group C on measurable performance;
      Criterion 1 (finished measurement -- length);
      Criterion 3 (finished measurement -- width);
      Criterion 4 (squareness to surface C -- width), and
      Criterion 10 (squareness of hole to surface C -- 5/8" hole).
      The conventional seventh grade industrial arts groups also performed significantly better than Group C on Criterion 5 (location of hole to surface A -- 1/4" hole) and Criterion 7 (squareness of hole to surface C -- 1/4" hole).

3. An analysis of covariance was performed on overall mean achievement, mean achievement on each operation, and mean achievement on each measurable performance criterion, with consideration given to the six selected cognitive achievement factors. By the use of the t-test, it was determined that the I.Q. arithmetic achievement, and composite achievement factors seemed to have a significant effect on the scores of performance on several of the measurable performance criteria; that all the cognitive achievement factors seemed to have a significant effect on the scores of performance on each operation; and that all the selected cognitive achievement factors seemed to have a significant effect on the overall performance score. F-tests revealed that when subtracting the effects of the cognitive achievement factors, there were still significant differences in performance on the mean achievement of each measurable performance criterion, on each operation, and on overall performance as reported above in 2 and 3. Therefore, the significant differences noted in 2 and 3 are not the effect of the cognitive achievement factors.

4. The coefficients of correlation between the students' mean achievement on Parts I and II of the manipulative-performance achievement test and their mean achievement on Part III of the test were analyzed. This analysis was performed to determine the effect of intervening achievement factors on their performance. The analysis revealed that while there were significant correlations between the intervening achievement factors and each operation for all three groups, there was only one significant correlation for each group which was common to the other groups: the correlation between the measurement achievement factor and overall performance.

5. An analysis of covariance was performed on the overall mean achievement, mean achievement on each operation, and mean achievement on each measurable performance criterion, with consideration to previous experience and home tool ownership. By the use of the t-test, it was revealed that only previous experience with the hand plane seemed to have any significant effect on

performance score of any operation. There were no significant effects for home tool ownership on any performance score. F-tests revealed that when subtracting the effects of the previous experience and home tool ownership factors, there were still significant differences among the groups on the mean achievem .t of each measurable performance criterion, on each operation, and on overall performance as reported above in 2 and 3. Therefore, the significant differences noted in 2 and 3 are not the effect of the related experience factors.

Several conclusions were drawn, supported by the findings:

1. It was determined that there was no significant difference for spatial perception achievement between the two industrial arts groups which were in the same school district. However, there was a significant difference between the students in the control group. It is possible that the difference between the industrial arts groups and the control group may have been caused by the use of different grading systems and not by the students' level of spatial perception achievement.

2. There was no set pattern for correlation between intervening achievement factors and the students' performance on the different manipulative activities.

3. There was no set pattern for correlation between the students' performance on one specific technical operation and their performance on other operations.

Comparison of Cognitive Achievement

William E. Dugger (1970) compared the achievement, in the cognitive domain, of IACP students in "The World of Construction" course with students in conventionally-taught industrial arts courses and with a third (control) group of students who had no industrial arts.

The design of the study was based on the achievement of three groups of students as determined on two different tests: (1) The Cooperative General Industrial Arts Test (Form A) produced by Educational Testing Service and (2) The Wcrld of Construction Comprehensive Examination (Form 2) developed by the IACP staff. The sample was composed of seventh grade students from Columbus, Ohio public and parochial schools.

The summary statistics on the General Industrial Arts Test for all three groups is found in Table 13. The data suggest that the mean achievement scores of the three groups on the conventional subject matter test were relatively similar. The mean for the national sample of seventh grade students reported by ETS as part of their norms was 26.6. This compares with a total mean of 25.6 for the students involved in this study. Likewise, the three groups had a nearly identical median with the parochial students scoring slightly lower than the other groups. The two reliability estimates are very respectable: each coefficient was greater than .70. These summary statistics presented are similar to the norms established by the Educational Testing Service in its handbook for this test.

The statistical findings of each group on the Cooperative General Industrial Arts Test are shown in Table 14. These findings indicate that there was no significant difference at the .05 level between the means of any of the three groups.

Table 15 summarizes the results of The World of Construction Comprehensive Examination which was used as the criterion to compare the achievement of the three groups on the innovative industrial arts curriculum subject matter developed by the IACP. The data presented in Table 16 reveal a significant difference in achievement between the IACP and the conventionally-taught industrial arts student at the .001 level. The same .001 level of confidence was achieved between the score of the IACP students and the non-industrial arts students. However, there was no significant difference between the scores of the non-industrial arts students and the conventionally-taught industrial arts students on The World of Construction Comprehensive Examination. Based on the statistical analysis of the data, the following conclusions were drawn:

1. The results of The World of Construction Comprehensive Examination revealed that the IACP students achieved at a significantly higher level than the conventionally-taught industrial arts students and the non-industrial arts students.

2. On the ETS Cooperative General Industrial Arts Test, students in the conventional industrial arts program did not perform significantly different from the non-industrial arts students and the IACP students.

SUMMARY STATISTICS FOR GENERAL INDUSTRIAL ARTS TEST (ETS)

	Statistics	Parochial (No IA)	Woodward Park J.H.S. (conven.)	Yorktown J.H.S. (IACP)
1.	Number of Students	82	84	121
2.	Number of Items on Test	50	50	50
3.	Mean	24.72	26.43	25.77
	a. Standard Deviation	6.62	7.71	7.26
4.	Median	24	26	26
5.	Mode	22	32	33
	a. Skewness	-0.17	-0.21	-0.12
	b. Kurtosis	-0.35	-0.09	-0.47
6.	Range	30	38	36
	a. Maximum	38	46	43
	b. Minimum	8	8	7
7.	Reliability Estimates:			
	a. K-R 20	0.769	0.807	0.807
	b. K-R 21	0.729	0.773	0.779
8.	Mean Item Difficulty	0.506	0.473	0.485
9.	Mean Item Discrimination	0.324	0.339	0.351

TABLE 13

STUDENT MEAN SCORES ON THE GENERAL INDUSTRIAL ARTS TEST (ETS)

Group	Mean Score	Standard Deviation	*t* value	Level of Significance Between Means
(a) IACP	25.7686	7.2589		<u>Not</u> significant at .05 level
(b) Conventional Industrial Arts	26.4268	7.2399	-0.6316 (Degrees of Freedom = 85)	
(c) Parochial (Non-Industrial Arts)	24.7195	6.6191	1.0597 (Degrees of Freedom = 85)	<u>Not</u> significant at .05 level
(a) IACP	25.7686	7.2589		
(c) Parochial (Non-Industrial Arts)	24.7195	6.6191		
(b) Conventional Industrial Arts	26.4268	7.2399	1.5664 (Degrees of Freedom = 85)	<u>Not</u> significant at .05 level

TABLE 14

SUMMARY STATISTICS FOR THE WORLD OF CONSTRUCTION COMPREHENSIVE EXAMINATION (Form 2)

	Statistics	Parochial (No IA)	Woodward Park J.H.S. (Conven.)	Yorktown J.H.S. (IACP)
1.	Number of Students	82	84	122
2.	Number of Items on Test	48	48	48
3.	Mean	21.79	22.59	28.90
	a. Standard Deviation	5.85	6.29	6.49
4.	Median	23	23	29
5.	Mode	24	27	29
	a. Skewness	-0.19	-0.10	-0.42
	b. Kurtosis	-0.34	-0.61	-0.32
6.	Range	27	26	29
	a. Maximum	37	35	41
	b. Minimum	10	9	12
7.	Reliability Estimates			
	a. K-R 20	0.710	0.757	0.784
	b. K-R 21	0.666	0.713	0.742
8.	Mean Item Difficulty	0.546	0.533	0.398
9.	Mean Item Discrimination	0.302	0.317	0.329

TABLE 15

STUDENT MEAN SCORES ON THE WORLD OF CONSTRUCTION COMPREHENSIVE EXAMINATION (Form 2)

	Group	Mean Score	Standard Deviation	t value	Level of Significance Between Means
(a)	IACP	28.9008*	6.2634	6.9520 (Degrees of Freedom=85)	*Significant at .001 level
(b)	Conventional Industrial Arts	22.5854	6.3534		
(c)	Parochial (Non-Industrial Arts)	21.7927	5.8513	8.2099 (Degrees of Freedom=86)	*Significant at .001 level
(a)	IACP	28.9008*	6.2634		
(c)	Parochial (Non-Industrial Arts)	21.7927	5.8513	.8260 (Degrees of Freedom=81)	Not significant at .05 level
(b)	Conventional Industrial Arts	22.5854	6.3534		

TABLE 16

It appears that IACP construction students learned just as much cognitive knowledge about conventional industrial arts subject matter as did most industrial arts students (as measured by the ETS test), and also learned additional information about the managed-personnel-production practices of construction technology (as measured by the IACP test).

Comparison of Affective Behavior

A study was conducted by Phillip A. Fazzini (1970) dealing with measurement in the affective domain of learning in the area of attitudes, specifically attitudes toward manufacturing industry. Data were obtained to measure and compare attitudes of subjects exposed to three educational programs.

The study was conducted in four Cincinnati, Ohio schools, two public and two parochial, using data obtained from 128 eighth grade boys in September, 1969, and May, 1970. These students were asked to respond to 53 statements indicating their degree of agreement or disagreement with, or uncertainty about, the statements which dealt with five major practices of manufacturing industry.

The first problem was to construct a scale which would measure attitudes without influencing the students by the use of certain words or phrases, or by sentence construction. To accomplish this, a number of statements were composed, validated by a panel of experts from education and industry and pilot tested for reliability. Then, the study was conducted and data were collected from which an analysis was made.

The data obtained from this investigation were analyzed and summarized as follows:

1. In regard to a comparison of the adjusted mean scores of the three treatment groups, there was 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 innovative group lowest.

2. In regard to a comparison of the pooled adjusted mean scores of the innovative and conventional groups with the adjusted mean score of the control group, there was no significant difference in attitudes toward manufacturing industry.

On the basis of the findings of the study, the following conclusions were drawn:

1. It was possible to construct a scale which will measure attitudes about manufacturing industry.

2. The fostering of positive attitudes was an attainable objective for industrial arts.

3. The conventional method of teaching was more successful in fostering positive attitudes toward manufacturing industry than the method used by the innovative program in this study (IACP World of Manufacturing).

4. The conventional program was more successful in fostering more positive attitudes toward automation and the occupational aspects of the manufacturing industry than was the innovative program.

5. The conventional program was more successful in fostering more positive attitudes toward working conditions and production aspects of the manufacturing industry than was the innovative program.

Although not supported by this study, it was possible that the innovative (IACP) industrial arts group's more neutral attitude toward manufacturing was, in fact, the result of participation in a highly organized, articulated, and realistic representation of manufacturing technology. This experience may have afforded students a background to discern and become more objective and critical toward the scale items which reflected the attitude, objects, and practices of industry.

A Comparative Evaluation of IACP and Conventional Industrial Arts Students

Following completion of the three foregoing studies, the IACP evaluation staff made the decision to carry out a comprehensive comparative evaluation of students enrolled in the IACP program with students in conventional programs of industrial arts education. Financial delimitations were established and a feasibility study was conducted to determine alternative proposals for the study. From this effort, the evaluation staff decided to conduct a study that would focus on cognitive achievement and affective behavior utilizing the population of students in both the Field Evaluation and Demonstration

Centers. Students enrolled in conventional industrial arts programs were chosen as the control group. A psychomotor dimension originally planned for the study was abandoned due to financial restrictions established for the study and because of problems inherent in managing the assessment of psychomotor performance.

A stratified random sample of students was selected from each of the IACP Field Evaluation and Demonstration Centers. Students were selected from construction and manufacturing classes as well as from conventional industrial arts classes. Demographic data for the students (intelligence quotient and socioeconomic level) who participated in this study were reported earlier in Chapter III. From the data collected, it appears that the students participating in the study were representative of the normal junior high school population.

The Study

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. A comprehensive review of the procedures and findings of this study may be found in a recently completed dissertation by Larry R. Miller (1971).

For this evaluation study, a posttest-only method was used with intact classroom groups. The study was concerned with three different groups: two groups were enrolled in IACP-developed industrial arts courses and one group 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 in order to control for any initial variations existing in known factors related to the variables under study.

Six independent variables of central concern were identified for the study:

1. "The World of Construction" course as institutionalized in the IACP Field Evaluation Centers.

2. "The World of Manufacturing" course as institutionalized in the IACP Field Evaluation Centers.

3. "The World of Construction" course as institutionalized in the IACP Field Demonstration Centers.

4. "The World of Manufacturing" course as institutionalized in the IACP Field Demonstration Centers.

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

6. "Industrial Arts II" which consisted of courses designed for students who have had one year of industrial arts education and who have focused primarily on one or more of the conventional industrial arts areas of woodworking, metalworking, electricity, and drafting.

Four evaluation instruments utilized as criterion measures for the evaluation of students participating in the study included:

1. The World of Construction Achievement Test Comprehensive Exam, developed by the IACP staff.

2. The World of Manufacturing Achievement Test Comprehensive Exam, developed by the IACP staff.

3. Cooperative General Industrial Arts Test Form A, developed by Educational Testing Service.

4. General Scale of Attitudes of Junior High School Industrial Arts, developed by Miller and Buffer.

Measures of intelligence (IQ) and social position (Hollingshead, 1957) were obtained for the students participating in the study and were used as control variables when making a comparative analysis of student performance.

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

Group		
IACP Construction Classes Field Evaluation Centers	$\boxed{R}$	T_1 T_2 T_3 T_4
IACP Manufacturing Classes Field Evaluation Centers	$\boxed{R}$	T_1 T_2 T_3 T_4
IACP Construction Classes Field Demonstration Centers	$\boxed{R}$	T_1 T_2 T_3 T_4
IACP Manufacturing Classes Field Demonstration Centers	$\boxed{R}$	T_1 T_2 T_3 T_4
Industrial Arts I Conventional Programs	$\boxed{R}$	T_1 T_2 T_3 T_3
Industrial Arts II Conventional Programs	$\boxed{R}$	T_1 T_2 T_3 T_4

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

$\boxed{R}$ The random assignment of each student to complete one of the four test instruments

T_1 The World of Construction Achievement Test Comprehensive Exam

T_2 The World of Manufacturing Achievement Test Comprehensive Exam

T_3 The Cooperative General Industrial Arts Test Form A

T_4 The General Scale of Attitudes of Junior High School Industrial Arts

The target population consisted of intact classes of subjects enrolled in the six groups as previously described. Table 17 details the number of students that participated in the study for which usable data were obtained.

Eight research questions were posed in order to investigate the major problem of this study. 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 as compared with students enrolled in the IACP program in the Field Demonstration Centers and students enrolled in conventional industrial arts courses?

2. What difference, if any, in the performance on The World of Construction Achievement Test Comprehensive Exam (T_1) exists between pairs of cells in the foregoing matrix?

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 as compared with students enrolled in the IACP program in the Field Demonstration Centers and students enrolled in conventional industrial arts courses?

4. What difference, if any, in the performance on The World of Manufacturing Achievement Test Comprehensive Exam (T_2) exists between pairs of cells in the foregoing matrix?

DISTRIBUTION OF STUDENTS IN THE
POPULATIONS TESTED

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

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

TABLE 17

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 as compared with students enrolled in the IACP program in the Field Demonstration Centers and students enrolled in conventional industrial arts courses?

6. What difference, if any, in the performance on the Cooperative General Industrial Arts Test (T_3) exists between pairs of cells in the foregoing matrix?

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 as compared with students enrolled in the IACP program in the Field Demonstration Centers and students enrolled in conventional industrial arts courses?

8. What difference, if any, in the performance on the General Scale of Attitudes of Junior High School Industrial Arts (T_4) exists between pairs of cells in the foregoing matrix?

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 25 individual students within each group investigated as warranted by the hypotheses. The sample size of 25 for each group was considered appropriate for the type of statistical treatment selected for the analysis of data.

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.

Data processing 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 and

Duncan's new multiple range test.

Findings and 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 subproblems.

The World of Construction Achievement Test Comprehensive Exam. Several findings were drawn from the analysis of data of the six samples of students completing The World of Construction Achievement Test Comprehensive Exam (T_1). Table 18 illustrates the summary statistics of the sample from which this analysis was made. The findings were:

1. Test T_1 appeared to discriminate between the six sample groups. On the fifty-item test, the unadjusted mean scores ranged from a high of 32.40 to a low of 20.28. The median scores had a similar dispersion from 33 to 20.

2. Test T_1 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 0.529 to 0.571 while those of the conventional industrial arts courses were 0.351 to 0.386. The reliability estimates for the IACP samples (0.917 to 0.928) as compared with the conventional industrial arts samples (0.795 and 0.816) 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 ($F = 46.487$) but not on the social position control variable ($F = 0.025$).

SUMMARY STATISTICS OF SAMPLE COMPLETING
THE WORLD OF CONSTRUCTION ACHIEVEMENT TEST COMPREHENSIVE EXAM

	IACP - Field Evaluation Centers		IACP - Field Demonstration Centers		Conventional Industrial Arts Programs	
	Construction	Manufacturing	Construction	Manufacturing	Industrial Arts I	Industrial Arts II
Number of Students	25	25	25	25	25	25
Median	29.0	26.0	33.0	28.0	23.0	20.0
Mean	26.0	27.36	32.40	27.08	21.84	20.28
Standard Deviation	10.70	11.33	10.50	11.24	7.04	7.62
Skewness	-0.14	0.06	-0.38	0.08	-0.01	0.33
Kurtosis	-0.99	-1.20	-0.75	-1.01	-0.76	-0.95
Range	41.0	36.0	38.0	36.0	25.0	27.0
Maximum	46.0	46.0	49.0	45.0	36.0	36.0
Minimum	5.0	10.0	11.0	9.0	11.0	9.0
K-R 20 Reliability Estimate	0.917	0.928	0.924	0.927	0.795	0.816
Mean Item Difficulty	0.474	0.453	0.352	0.478	0.486	0.537
Mean Item Discrimination	0.531	0.571	0.529	0.571	0.351	0.386

TABLE 18

4. The two-way analysis of covariance revealed that variance B (across programs) had a significant F-ratio of 7.313, but variance A (by levels) and AB interaction were not significant with F-ratio values of 0.744 and 2.602 respectively.

5. The comparisons of the adjusted paired means for the six sample groups using Duncan's new multiple range test 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 explanation 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. The achievement scores, however, 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 having been enrolled in construction for one year, the students who 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.

5. It appears that the industrial technology concepts are cumulative when "The World of Manufacturing" course is provided to build upon the concepts and principles learned previously in "The World of Construction." This finding is supported by the research results recently reported by Kuwik (1970) and Walgren (1971) who also reported that the study of manufacturing concepts after completing a course in construction results in cumulative cognitive knowledge of industrial technology.

The World of Manufacturing Achievement Test Comprehensive Exam. From the analysis of data (Table 19) of the six sample groups of students who completed The World of Manufacturing Achievement Test Comprehensive Exam (T_2), several findings can be reported.

1. Test T_2 appears 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 discriminations for the two groups of manufacturing students were 0.457 and 0.559, while the other four groups ranged from 0.263 to 0.344. The reliability estimates for the manufacturing (0.889 and 0.923) as compared with the construction and conven-

SUMMARY STATISTICS OF SAMPLE COMPLETING THE WORLD OF MANUFACTURING ACHIEVEMENT TEST COMPREHENSIVE EXAM

	IACP - Field Evaluation Centers		IACP - Field Demonstration Centers		Conventional Industrial Arts Programs	
	Construc-tion	Manufac-turing	Construc-tion	Manufac-turing	Industrial Arts I	Industrial Arts II
Number of Students	25	25	25	25	25	25
Median	19.0	25.0	20.0	23.0	18.0	16.0
Mean	18.76	24.92	20.36	25.36	17.20	16.48
Standard Deviation	5.82	9.32	5.84	11.07	5.06	6.82
Skewness	-0.15	0.15	-0.04	0.27	-0.19	0.50
Kurtosis	-1.03	-0.54	-0.58	-0.97	-1.07	-0.50
Range	21.0	37.0	24.0	41.0	18.0	28.0
Maximum	29.0	43.0	33.0	48.0	25.0	33.0
Minimum	8.0	6.0	9.0	7.0	7.0	5.0
K-R 20 Reliability Estimate	0.708	0.522	0.714	0.493	0.601	0.611
Mean Item Difficulty	0.291	0.457	0.280	0.569	0.263	0.344
Mean Item Discrimination	0.334	0.351	0.429	0.360	0.346	0.346

TABLE 19

tional industrial arts students (0.601 to 0.788) 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 ($F = 44.586$) but not on the social position control variable ($F = 0.397$).

4. The two-way analysis of covariance revealed that variance A (by levels) and variance B (across programs) had significant F-ratios of 9.433 and 3.220 respectively. The F-ratio of 1.196 for AB-interaction was not significant.

5. The comparison of the adjusted paired means for the six sample groups using Duncan's new multiple range test 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 students did not take.

Several conclusions seemed to be warranted from the findings pertaining to the six sample groups 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 (Table 20) of the six sample groups of students who completed the Cooperative General Industrial Arts Test (T_3).

1. The 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 0.674 to 8.34. The reliability estimates were somewhat similar with a high of 0.860 to a low of 0.781. All six groups had low mean item discrimination indexes (0.334 to 0.429).

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 32.350 and 6.578 respectively.

3. The two-way analysis of covariance revealed that variance A (by levels) had a significant F-ratio of 5.225, but variance B (across programs) and AB-interaction were not significant with F-ratio values of 0.818 and 0.169 respectively.

4. The comparisons of the adjusted paired means for the six sample groups using Duncan's new multiple range test revealed that only one pair of adjusted means were significantly different -- that being the manufacturing students in the Field Evaluation Centers who 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:

SUMMARY STATISTICS OF THE SAMPLE COMPLETING THE COOPERATIVE GENERAL INDUSTRIAL ARTS TEST

	IACP - Field Evaluation Centers		IACP - Field Demonstration Centers		Conventional Industrial Arts Programs	
	Construction	Manufacturing	Construction	Manufacturing	Industrial Arts I	Industrial Arts II
Number of Students	25	25	25	25	25	25
Median	19.0	25.0	25.0	25.0	23.0	20.0
Mean	21.80	26.52	23.08	25.20	23.08	20.96
Standard Deviation	6.74	7.26	8.34	7.29	6.82	6.97
Skewness	0.43	-0.41	0.05	0.00	-0.07	0.55
Kurtosis	-1.20	-1.18	-1.04	-1.15	-0.66	-0.41
Range	21.0	24.0	30.0	25.0	28.0	27.0
Maximum	34.0	35.0	41.0	37.0	37.0	37.0
Minimum	14.0	11.0	11.0	12.0	9.0	10.0
K-R 20 Reliability Estimate	0.783	0.816	0.860	0.812	0.781	0.793
Mean Item Difficulty	0.564	0.581	0.538	0.496	0.538	0.581
Mean Item Discrimination	0.334	0.346	0.429	0.360	0.346	0.346

TABLE 20

a) The cognitive content as measured by T_3 (conventional industrial arts concepts) was mastered by students who 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 providing 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, having been adjusted using two control variables: intelligence quotient and social position.

General Scale of Attitudes of Junior High School Industrial Arts. Several findings can be reported from an analysis of data (Table 21) of the six sample groups 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 scale, the unadjusted mean scores for the six groups had a range of 15 points (198.6 to 213.36). The median scores had a smaller range with a high of 210 and a low of 202.

SUMMARY STATISTICS OF THE SAMPLE COMPLETING THE GENERAL SCALE OF ATTITUDES OF JUNIOR HIGH SCHOOL INDUSTRIAL ARTS

	IACP - Field Evaluation Centers		IACP - Field Demonstration Centers		Conventional Industrial Arts Programs	
	Construction	Manufacturing	Construction	Manufacturing	Industrial Arts I	Industrial Arts II
Number of Students	25	25	25	25	25	25
Median	205.0	207.0	202.0	203.0	206.0	210.0
Mean	208.56	207.96	198.16	200.88	205.92	213.36
Standard Deviation	16.36	16.80	21.01	20.39	19.68	19.80
Range	64.0	68.0	94.0	99.0	85.0	95.0
Maximum	245.0	241.0	233.0	232.0	246.0	261.0
Minimum	181.0	173.0	139.0	134.0	161.0	167.0
K-R Reliability Estimates	0.836	0.823	0.824	0.837	0.827	0.834

TABLE 21

However, the standard deviations for the groups were relatively large ranging from 16.36 to 21.01. The reliability estimates were quite similar (0.823 to 0.837).

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 ($F = 2.201$) and social position ($F = 0.154$).

3. The two-way analysis of covariance revealed that variance A (by levels) had a nonsignificant F-ratio of 0.556, variance B (across programs) had a nonsignificant F-ratio of 2.247, and AB-interaction was nonsignificant with an F-ratio of 0.164.

4. Only one of the fifteen paired means was found to be significant using Duncan's new multiple range test. Industrial Arts II students scored significantly higher on T_4 than did the construction students in the Field Demonstration Centers. Two possibilities are suggested for the overall lack of discrimination between the six sample groups that completed T_4:
   a) The activities of the variables of control concern were similar in relation to the degree of affective behavior measured by T_4.
   b) The items on T_4 were not technically well written to discriminate between students with different attitudinal behaviors.

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.

General Conclusions and Recommendations of the Study. The following general conclusions were made based on the analysis of the data and findings reported in this study:

1. The IACP instructional system is a viable alternative to conventional industrial arts education based on the results of this study in that the students enrolled in the IACP program performed as well as conventional industrial arts students on the ETS achievement test (knowledge taught in conventional industrial arts educ tion) and better than the conventional students on the two tests designed to measure the cognitive achievement of the IACP program. It is recommended that the IACP instructional system be adopted in any school industrial arts program, if and when the IACP objectives are in accord with those of the school system contemplating adoption.

2. The World of Construction Achievement Test Comprehensive Exam is 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 is an adequate test for measuring the cognitive control of "The World of Manufacturing" course and is recommended for that purpose.

4. Although the General Scale of Attitudes of Junior High School Industrial Arts did not discriminate between the six groups investigated in this study, it appeared to be a modestly well-conceived attitude scale in that it has good content validity and reliability using the K-R formula 8 estimate. In addition, it was the only instrument used in this study that was not dependent on the intelligence quotient or social position covariates.

An Analysis of Questionnaires and Interviews

This section will present an analysis of questionnaires and interviews completed by students, teachers, parents, school administrators, and industrialists to provide information of value in assessing the impact and acceptance of the IACP programs. The detailed analysis of each item was used as a valuable source of feedback information in revising the third and fourth edition materials for each course.

The survey instruments were developed by the IACP evaluation staff using the questioning matrix described in the evaluation rationale section of Chapter III. A panel of project experts and field staff critically reviewed and assisted with the revision of the questionnaires, and pilot studies were conducted to validate the instruments. These inputs were used to produce the revised instruments that were utilized by the IACP staff.

Survey of IACP Students

A survey was conducted to obtain attitudinal knowledge concerning the IACP program from students enrolled in "The World of Construction" and "The World of Manufacturing." The target population for the study consisted of students enrolled in the six Field Evaluation Centers of the IACP. From this population, a twenty percent sample was randomly selected. The instrument administration and collection of data were handled by the Field Evaluation Center directors and teachers under the coordination of a research associate at the OSU headquarters.

About 96 percent of the sample completed "The World of Construction" instrument which totaled 482 responses. "The World of Manufacturing" returns numbered 398 or an 86 percent return. The non-responses were accounted for by absenteeism as the questionnaires were administered or collected and returned to OSU.

An analysis of the survey instruments indicated that the students enjoyed the IACP program, would recommend it to their friends, and felt that every student should have a chance to take the courses. In addition, students felt they had a good understanding of construction and manufacturing, that the study would be of value to them later in life, and that the study was helpful in career selection. It should be noted that only 37 percent of the students indicated an interest in an industrial career. These data tend to support the contention that the courses were providing relevant occupational orientation and that students were better qualified to consider a career selection.

Student responses to the construction and manufacturing questions are presented in percentage figures on the following pages. One must be cautioned in considering these data, however, since the student questionnaire for construction was administered to students using third edition materials, while the questionnaire for manufacturing obtained information from students using second edition materials. As a result of major revisions in activities and format of selected third edition manufacturing materials, and program observations by Field Evaluation Center directors and teachers, it is believed that the questionnaire results for manufacturing would have been more positive if third edition manufacturing materials could have been used and included here. Due to the utilization of Field Evaluation Center teacher time in other segments of the program evaluation effort, it was decided not to readminister this questionnaire using third edition manufacturing materials. Nevertheless, a review of the student questionnaire suggested very positive opinions regarding the IACP courses.

Appropriate comments and a summary of the student questions are presented in the following pages. A tabulation of student responses in percentage figures on the student questionnaire form is included in Appendix F.

Summary of Students' Questionnaires. The responses to questions 1, 2, and 3 indicated that the students in both courses had favorable attitudes toward each course. They enjoyed studying the course, would recommend it to their friends, and thought that all junior high school boys should have an opportunity to take the IACP courses.

The students' opinion of their learning and its value was determined by questions 4 and 5. Most of them felt that they understood construction or manufacturing and that this knowledge would be of some value to them later in life.

Occupational interest was covered by questions 6 and 7. Apparently, IACP helped students decide whether they might want to work in some phase of construction or manufacturing. There was an even distribution among those who said yes or no, and those who were undecided.

The students were quite positive about their interest in the IACP course, as evidenced by question 9, indicating that they usually wanted to spend more time in class than was allowed. They also indicated some interest in studying more courses in construction or manufacturing in the future (question 8).

Since the laboratory activities are an important part of the teaching-learning package, several questions (10, 11, 12, 13, 16, 17, 18, 19, and 25) were constructed to determine the students' interest and opinion of the materials and activities in this area. The students indicated that they were able to perform the laboratory activities, found them to be exciting, preferred to have more of them, and felt that not enough time was provided for such activities. They felt that the laboratory manual was easy to follow. Most of them enjoyed working in groups, although some preferred to work alone. Many did not like working under a student foreman, perhaps because only a few of them had an opportunity to serve in that capacity.

Question 15 found that many students were undecided about home reading assignments or did not feel that they were necessary. They further demonstrated a negative attitude toward the textbook readings (question 14), where many either did not like or were undecided about finding the textbook readings interesting.

Questions 20, 21, and 22 were included to measure the students' opinion of course organization. Most of the students felt that construction or manufacturing, as presented, was easy to understand and that the second semester was more interesting than the first. They also wanted to make more take-home projects.

The students felt that laboratory space, materials, tools, and equipment available to them during their study of construction and manufacturing were adequate (questions 23 and 24).

Survey of Parents of Students Enrolled in IACP

The major objective of this survey was to gain reactions and opinions concerning the IACP from parents of students enrolled in "The World of Construction" and "The World of Manufacturing." From this population, a twenty percent sample was randomly selected. The instrument administration and collection of data were coordinated by a research associate with the cooperation of the Field Evaluation Center directors and teachers.

Of the 480 questionnaires distributed, 225 were returned by parents of students enrolled in "The World of Construction," a total of about 53 percent of the target sample. Seventy-two percent of the sample involving parents of students enrolled in "The World of Manufacturing" responded. Combined responses from parents concerning the two IACP courses totaled 56 percent of the selected sample.

An analysis of the survey instruments indicated that 85 percent of the parents had a favorable response toward the IACP program. In addition: (1) favorable comments from their children about the program outweighed unfavorable comments eight to one, (2) visitation of the program by parents was made by over half the respondents, and (3) 65 percent of the parents had examined the textbooks being used.

Approximately 50 percent of the parents felt that it was the responsibility of industrial arts to help students identify their career or occupational interests. However, 80 percent of the respondents were affirmative in regard to whether or not the IACP program gave the child an opportunity to learn about possible occupational or career interests.

The reader must again be advised that questionnaire responses were based upon third edition materials for "The World of Construction" and second edition materials for "The World of Manufacturing." Had parents of manufacturing students been exposed to third edition materials, as were the parents of construction students, parent responses of manufacturing students might have been somewhat better than those presented here. Nevertheless, the general parental reaction to both IACP instructional programs was highly favorable.

The next few pages contain a summary of parents' reactions. A presentation of the tabulated results of parent responses in percentage form is included in Appendix G.

<u>Summary of Parents' Questionnaires</u>. Responses to questions 2 and 3 indicated that the parents observed that their children frequently made favorable comments about IACP, and seldom expressed a dislike for the program.

The parents' opinions about the IACP and conventional industrial arts courses were elicited by questions 1, 4, 5, 6, 10, and 11. The parents held the opinion that industrial arts should not restrict itself primarily to handicraft activity and that modern industry cannot be adequately taught in the conventional program of woodworking, metals, and drafting. They did not prefer to have their children concentrate on the development of skills rather than a broad coverage of industry, and they were not disappointed that their children were not making numerous take-home objects. They strongly indicated that IACP had been an asset to their children's education, and felt that their children benefited more from IACP than they would have from a conventional industrial arts program.

In questions 7, 8, 9, 15, 18, parents were asked about the career and occupational effects of the IACP. Most of them were of the opinion that industrial arts had a responsibility to help students identify their career or occupational interests and indicated that the

IACP created such an opportunity. A few parents indicated that their children had expressed an interest in some occupation as a result of IACP. They also felt that industrial arts activities would provide an opportunity for their children to identify possible careers; and that even if their children did not decide on an occupation in the construction or manufacturing industry, the children would still benefit from the study of construction or manufacturing.

The parents were convinced of the importance of construction and manufacturing as subject matter in general education, as shown by their responses to questions 12, 13, 14, 16, and 17. They were almost unanimous in stating that the study of construction or manufacturing practices and techniques was important; that it was important for their children to know about home construction or consumer production and about purchasing such products; and that it was important for their children to know about labor unions and management.

The parents themselves evidenced a very favorable opinion of IACP (questions 19, 20, 21, 22). They thought they themselves could have profited from such a course when they were in junior high school. Most of them had looked at the IACP books and found them interesting, appropriate for junior high school age youth, up-to-date, representative of contemporary industrial technology, and indicative of the type of learning they wanted their children to receive. Well over half of the parents had visited the IACP setting and were favorably impressed with it.

Survey of Administrators in IACP Schools

The major objective of this survey was to gather data from the principals of the 24 schools that comprised the IACP Field Evaluation Centers for "The World of Construction" and "The World of Manufacturing." Of the 24 principals in "The World of Construction" target population, 23 completed and returned the questionnaire for a 96 percent return. Of the 23 "World of Manufacturing" principals, 21 returned completed questionnaires for a 91 percent return.

An analysis of the survey summary sheet supported the contention that the principals were overwhelmingly favorable to the IACP courses. The administrators surveyed indicated they unanimously favored the program over comparable conventional programs, and agreed that the program not only presented an accurate picture of construction and manufacturing technology but also provided a good understanding of career orientation and the "world of work."

Of the respondents, 86 percent favored the structure of the IACP courses as opposed to conventional offerings in the area of industrial arts. Also, the principals were in agreement that the students were highly enthusiastic about studying construction and manufacturing and that they intended to continue offering the course after the field testing period.

The next few pages contain a summary of the data supplied by the respondents. A presentation of the data for both construction and manufacturing questionnaires in percentage form is included in Appendix H.

Summary of Administrators' Questionnaires. The principals were questioned about the value of IACP as it compared to conventional industrial arts programs, in items 2, 3, 4, 5, and 15. There was almost total agreement that IACP gave students a more comprehensive understanding of the "world of work," occupational opportunities, and materials and practices than did the conventional industrial arts programs. The principals were also favorably impressed with the structured method used in IACP and felt that students in this program continued to develop a basic knowledge of the use of hand and power tools.

The principals were asked to respond concerning their observations of the reactions of students, parents, and teachers to IACP through questions 6, 7, 9, 10, 11, 13, and 14. They noted highly favorable student enthusiasm for IACP and indicated that parents had observed the IACP classes with favorable comments. These parent visitations were also noted as being greater in number than visitations to other instructional programs in the school. The principals also observed that the attitudes and performance of their industrial arts teachers who were teaching the IACP program had improved since its installation, and that other teachers in the school had shown an interest in the program.

The principals themselves were of the opinion that the overall IACP program was appropriate for junior high school students, that it presented an accurate picture of construction and manufacturing, and that all junior high school students would benefit from the program (see questions 1, 8, and 12). In responding to question 40, principals indicated that as a group they would continue with IACP after the experimental phase had ended. Although some of them believed that there was too much reading involved in the program, they felt there was a transfer of subject matter learning to other subject areas (see questions 18 and 39).

Some of the items in the questionnaire were devoted to administrative problems, e.g., questions 16, 17, and 19 through 38. The principals indicated that the placing of slow learners in IACP created few problems and resulted in greater success for students than in conventional industrial arts courses. They indicated that IACP courses cost more per student to operate than the conventional program, but did not agree whether or not it would cost more to equip and maintain a new laboratory or a conventional one. They did feel, however, that the IACP program was worth a higher budget. There seemed to be no great problems connected with scheduling, time, transfer students, discipline, or custodial work.

Interviews of IACP Principals

Since the value of feedback information from school administrators was recognized, particularly as it related to implementation of the courses and their effect on the total school program, a decision was made to interview each principal of Field Evaluation Center schools. Using a prepared set of questions, field center directors conducted these interviews during the 1968-69 school year. Specific responses to the following questions asked of principals can be found in Appendix H.

1. What, if any, additional scheduling problems has the IACP program caused in your school?

2. What, if any, new problems or conflicts (custodial, disciplinary, etc.) in the operation of the school occurred as the result of the inclusion of the IACP program in the curriculum?

3. What, if any, opinions have community organizations, parents, or other individuals expressed about the IACP program?

4. In your opinion, what, at this point in time, are the strongest features or characteristics of the IACP program? The weakest features?

5. How does the cost of operating the IACP program compare with the cost of operating past industrial arts programs? If the operating cost of IACP is more, how is this cost being met?

6. How adequately do you believe the IACP programs meet the needs of all the students in your school?

7. What indications of interest or disinterest have you received from your students?

8. Has there been any indication of carry-over of subject matter from the IACP program to other subject areas?

9. What indications of interest have you received from teachers (other than industrial arts) in your school? Construction and manufacturing teachers? Other industrial arts teachers?

10. In what ways, if any, has your understanding of industrial arts changed since becoming involved with the IACP?

11. Please make a brief statement which summarizes your feelings about the IACP programs at this time.

12. What additional comments do you have?

Analysis of Teachers' Questionnaires Concerning IACP Materials

Even though daily feedback material from teachers was used to revise the software materials, it was felt that an overall evaluation of the textbooks, laboratory manuals, teacher's guides, filmstrips, slides, transparencies, hardware (jigs and fixtures), achievement tests, and course objectives would be beneficial. Questionnaires covering these items for "The World of Construction and "The World of Manufacturing" were developed and completed by 33 construction teachers and 33 manufacturing teachers from the six Field Evaluation Centers and ten Demonstration Centers.

These questionnaires were administered in February, 1971. Consequently, the construction teachers evaluated the fourth edition, commercial materials while the manufacturing teachers evaluated the third edition, developmental materials. The reader must be cautioned about the results of this evaluation because the fourth edition, commercial materials are superior in many ways to the developmental materials; therefore, responses to many items on the manufacturing questionnaire may be less positive than they might have been if the commercial edition had been evaluated.

Though specific questions differ because of the subject matter content, there were common areas into which certain questions from both questionnaires could apply. These common areas were identified from the questionnaire and discussed as they pertained to each software article.

Overall reaction to both questionnaires is recorded first, followed by reactions to each separate questionnaire.

Composite Reaction to Software. A five-point summative scale (Likert-technique) ranging from "Strongly Agree" to "Strongly Disagree" was used to assess opinions. Seventy-seven questions covering construction software and 87 covering manufacturing software were asked. The combined responses from each instrument indicated that the software materials were generally considered to be well developed with few reactions indicating a strong concern about the acceptability of the materials. See Figure 16.

Comparison of Responses on Both Questionnaires. Overall percentages were calculated for both the construction and the manufacturing questionnaires to show the differences in agreement. These results can be compared by observing the histogram in Figure 17. The histogram shows a high degree of correlation between the respondents' reaction to each category on the Likert scale.

The level of acceptance was greater for the construction software materials. As explained earlier, these results should be expected since the construction materials were in commercial form while those for manufacturing had undergone only two revisions and were still in developmental form.

Analysis by Areas: Construction and Manufacturing. There were six areas common to both questionnaires. Each software item was analyzed and evaluated, if applicable, in terms of the following areas: (1) organization, (2) instruction, (3) quality and durability, (4) equipment, supply and media lists, (5) suitability of teaching aids, and (6) testing. Responses of "Strongly Agree" and "Agree" were combined as one response and likewise for "Disagree" and "Strongly Disagree." Those choosing the category "Undecided" and those who did not respond were reported separately.

AGREEMENT SCALE -- IACP SOFTWARE

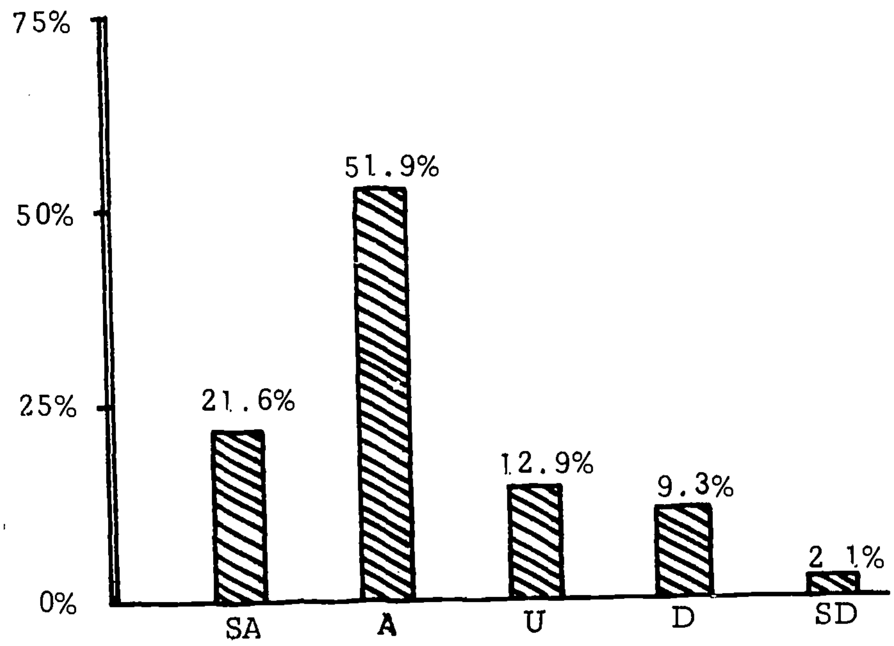


FIGURE 16

COMPARATIVE
AGREEMENT SCALE -- CONSTRUCTION AND MANUFACTURING

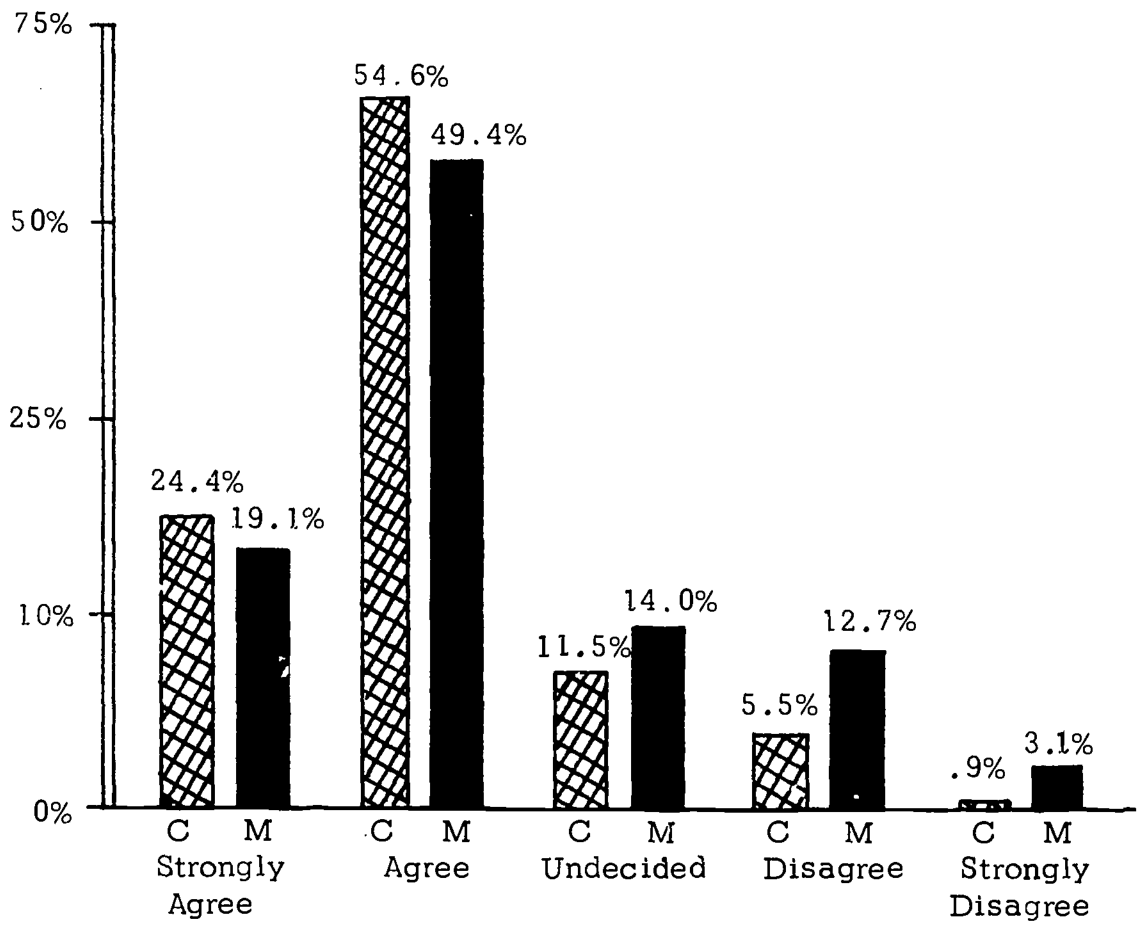


FIGURE 17

I. Construction Software Analysis:

A. Laboratory Manual

1. Organization. The characteristic most favored by the respondents was the graphic illustrations, 96 percent; 78 percent said they helped students perform activities, and were attractive and of high quality. Also, 87 percent felt the format of sequential organization assisted the student in carrying out laboratory activities.

2. Instruction. Even though almost all respondents (96-99 percent) agreed that the laboratory activities were well correlated with the textbook readings and were appropriate and necessary for understanding industrial concepts of construction technology, students were not as interested in certain management-oriented practices as they were in those representing production practices. It was reported (only 39 percent agreed) that all students do not read and follow directions in the laboratory manual and, as would be expected, those who complete all activities attain a better understanding of the concepts presented. Complete agreement was recorded (99 percent) for simulating construction practices by having boys work in gangs. It was generally agreed (72 percent) that adequate time was provided for completing laboratory activities, although 9 percent felt more time was necessary.

3. Quality and Durability. Seventy-two percent of the respondents agreed that, overall, the laboratory manual is well designed to withstand daily use by the student during his study of construction.

B. Teacher's Guide

1. Organization. Ninety-six percent of the respondents agreed that the teacher's guide is designed and organized to help the teacher perform efficiently and effectively. Equal agreement (90 percent) was registered for the accuracy and completeness of the table of contents and for the organization of discussion and presentation materials for ease in teaching.

2. Instruction. Behavioral objectives, according to 87 percent of the teachers, were clearly stated, understandable, and obtainable. One hundred percent agreed that the directions for organizing and conducting laboratory activities can be easily understood and 96 percent agreed that adequate explanation was given for teacher demonstrations. Less agreement (72 percent) was registered for the adequacy of instructions for conducting City and Regional Planning. Agreement as to whether students could generally satisfy the objectives, after completing the daily assignments, was recorded as 66 percent for the text, 69 percent for the discussion section, and 81 percent for the laboratory activities. Ninety percent felt that adequate attention was given to safety precautions for laboratory activities. Review prior to testing appeared to be helpful for students to better understand concepts previously covered, while support for the number of student reading assignments was not as strong; 63 percent agreed that the number was realistic and 18 percent disagreed.

3. Quality and Durability. The loose-leaf method of binding found favor with 96 percent of the respondents, as did the size and type face for facilitating the reading of the material. Ninety-three percent thought the hardware used was functional and 81 percent agreed that it could withstand continuous student use.

4. Equipment, Supply, and Media Lists. The usefulness, completeness, and accuracy of the equipment and supply lists in the appendices was upheld by 87 percent while 3 percent disagreed.

5. Suitability of Teaching Aids. The teaching aids used in "The World of Construction" found favor with a majority of respondents. Listed in descending order of agreement the items were: transparencies were helpful in teaching, 93 percent; students were interested in viewing filmstrips, 84 percent; filmstrip -- "Introduction to the WOC" provided an interesting overview, 78 percent; filmstrips show up-to-date construction practices, 72 percent; and scripts for filmstrips were accurate, concise, and descriptive, 66 percent. The greatest percentage of disagreement for any of the five items was 5 percent with no responses in the strongly disagree category.

6. Testing. Only 30 percent agreed that achievement tests should be used primarily to evaluate students (assign a course letter-grade), while almost all (93 percent) agreed that teacher assessment of student performance along with test results could provide a basis for evaluation. Seventy-eight percent did agree that the tests do provide useful information relative to student performance which can be used to improve the teaching-learning process. Eighty-seven percent also thought that an adequate number of achievement tests were given for the course.

C. Textbook

1. Organization. Almost complete agreement (96-100 percent) was recorded for the following characteristics of the textbook's organization: photographs and illustrations were attractive and professional, portrayed construction practices accurately, and helped students to better understand the practices and concepts presented; type face and size, format of the reading material, appropriateness of topic sequence, and accuracy and completeness of the table of contents were also rated positively by 90-96 percent of the respondents. A few teachers (9 percent) felt that more color could have been used to make the book more appealing.

2. Instruction. Even though most respondents (93-96 percent) agreed that the text includes major practices and presents an up-to-date and accurate portrayal of "The World of Construction," and that the material is appropriate for junior high school (72 percent), only 42 percent of the students found the readings interesting and appealing. This lack of appeal might depend to some extent upon the fact that the material would appear difficult to understand for those with a reading level below 7th grade, as reported by over 50 percent of the teachers. There was strong agreement (96 percent) that the concepts covered in the text were reinforced with laboratory activities. Even though there was general agreement (45-72 percent) that the cognitive maps, "Terms to Know," and "Think About It" questions were of value in helping students conceptualize, understand, and synthesize, there was considerable uncertainty about the value of these items since respon-

ses ranged from 21-39 percent undecided. A few (0-15 percent) responded negatively indicating that they felt these items were of little value.

3. Quality and Durability. Most teachers indicated that the quality and durability of the text binding, paper, and cover stock were adequate for school use.

II. Manufacturing Software Analysis

A. Laboratory Manual

1. Organization. Ninety-four percent thought the illustrations and photographs used in the laboratory manual helped students to understand and perform the activities. Yet only 47 percent agreed that the illustrations and photographs were attractive enough and of professional quality. Seventy-three percent felt the organizational sequence aided students in performing the activities while 19 percent were still uncertain.

2. Instruction. Most teachers (94 percent) agreed that it is necessary for students to apply concepts through laboratory activities to have a good understanding of manufacturing technology, and that activities like the coat hanger are effective in teaching the advantages of mass production processes over custom production processes. It was generally agreed (87-89 percent) that the activities presented were directly related to text readings and that they helped pupils understand concepts presented in the text. Students' interest in doing activities representing the three types of practices varied considerably. The activities of a production nature ranked highest, 95 percent; while those for management and personnel were considerably lower with 46 percent and 49 percent respectively. Role-playing seemed to be an effective teaching method for understanding certain labor-management functions even though only 60 percent of the teachers agreed that students liked role-playing activities. While the laboratory manual material appeared to be appropriate for students with a reading ability of 7th and 8th grade range, and teachers generally agreed (67 percent) that students completing charts and questions learned more, they were about equally divided (38 percent agreed, 46 percent disagreed) over the degree to which students

read, understood, and followed procedures listed in the manual. Teachers generally agreed (86 percent) that students are not disappointed with the lack of take-home projects. Eighty-one percent were in agreement that initiation of manufacturing practices is accomplished by having students work together as members of management and production groups. The fact that the questionnaire was distributed in February had a tendency to reduce the accuracy of the data. This was so because, in many cases, teachers, particularly in the Demonstration Centers, were "undecided" from lack of experience, or, they simply did not respond to a number of items because they had not yet taught those materials which were referred to specifically. The effects of this situation are especially pronounced in the analysis of the following items. There was a general feeling that more time was necessary for completing laboratory activities as 35 percent agreed with the budgeted time while 43 percent disagreed and 11 percent did not respond. A slightly more positive reaction (46 percent agreed, 21 percent disagreed, 14 percent no response) was registered for the adequacy of the proportion of group and individual activities. To the question of whether the activities of the corporation unit helped students to better understand manufacturing practices, 49 percent agreed that they did while 5 percent disagreed, 32 percent did not respond and 14 percent were undecided. Fifty-four percent of the teachers thought the manufacture of the high-intensity lamp was well organized and well presented while 5 percent disagreed and 24 percent failed to respond. There was some concern as to whether students were interested in participating in the corporation activities as 35 percent agreed that they did, 8 percent disagreed, 32 percent did not respond and 24 percent were undecided.

3. Quality and Durability. Sixty-seven percent agreed the laboratory manual was well designed to withstand daily student use while 13 percent disagreed, 11 percent did not respond and 8 percent were undecided.

B. Teacher's Guide

1. Organization. Ninety-seven percent and 98 percent respectively of the teachers confirmed that the guide

was designed and organized for efficiency and that discussion and presentation sections were written for ease in presenting material to students. Most teachers (83 percent) felt that the table of contents was accurate, complete, and useful.

2. Instruction. It was generally felt (75 percent agreed -- 11 percent disagreed) that the behavioral objectives were clearly stated, understandable, and obtainable, and that students, after completing daily assignments, generally satisfied those for discussion and laboratory activities. However, only 65 percent agreed that they met the objectives of the textbook and 19 percent stated that they did not. Seventy-three percent to 76 percent thought the explanation for demonstrations was adequate and that directions for organizing and conducting laboratory activities were easily understood while 8 percent in each case disagreed. Almost all teachers (94 percent) felt that directions for constructing the Land Speed Record Assault Vehicle were satisfactory; responses for making the model rocket were somewhat less favorable with 54 percent agreeing and 32 percent disagreeing, 13 percent also were either undecided or chose not to respond. Since, at the time the questionnaires were completed, many teachers had not yet manufactured the lamp, only 50 percent agreed that instructions were adequate while 49 percent either failed to respond, were undecided, or disagreed. Reviews prior to tests seemed to be helpful in providing students with a better understanding of concepts covered earlier and most (76 percent) teachers felt that safety for laboratory activities was covered adequately. The appropriateness of the number of reading assignments appeared to be questioned as 59 percent agreed the number was satisfactory, 19 percent were undecided, and 27 percent felt the number was unrealistic.

3. Quality and Durability. A loose-leaf type binder appeared to be the recommendation by 92 percent of the teachers. Generally, the type face and size were considered adequate for ease in reading as shown by 81 percent for and 6 percent against. The hardware was considered to be functional by 86 percent but over 50 percent felt that it was not durable enough

to withstand continuous use by students.

4. Equipment, Supply, and Media Lists. Three-quarters of the teachers felt that the equipment and supply lists were accurate, complete, and useful while one-fourth of them disagreed or were undecided.

5. Suitability of Teaching Aids. Eighty-nine percent agreed that the introductory filmstrip on "The World of Manufacturing" provided an interesting overview but only 54 percent agreed that the filmstrips, in general, were interesting to the students. It was generally agreed (70 percent) that the filmstrips showed up-to-date manufacturing practices but that the scripts could still be made more concise and accurate since only 62 percent agreed they were good and 38 percent either disagreed or were undecided.

6. Testing. Only 58 percent of the teachers felt the achievement tests provided useful information for improving the teaching-learning process. However, 92 percent agreed that they provided useful information to be used along with other supplementary information for arriving at students' grades, and that they should not be used as the primary source for determining grades.

C. Manufacturing Textbook

1. Organization. Most teachers agreed (94 percent to 95 percent) that the organizational format, type face and size, captions, etc., were of good design and adequate for the junior high school level. Between 89 percent and 90 percent of the respondents felt that the photographs and illustrations accurately portrayed manufacturing practices and were valuable in helping students understand the concepts and practices presented. The table of contents and index appeared to be accurate, complete, and adequate according to 89 percent of the teachers. They also felt that the sequence of readings was appropriate. Strong disagreement was registered for the absence of color, which indicated the need for serious consideration for the use of color in the text. (The developmental materials were in

black and white only, and the commercial edition of the textbook, as with construction, does include color.)

2. Instruction. Even though 97 percent reported that the readings included major manufacturing practices and 88 percent agreed that they presented an accurate and complete story of "The World of Manufacturing" with up-to-date processes, only 57 percent of the teachers agreed that the material presented was appropriate for the maturation level of junior high school students. Over half (65 percent) agreed that the material was understandable for those reading between the 7th and 9th grade levels while only 5 percent agreed that students reading below 7th grade could understand the material. This accounts somewhat for the concern of teachers over the appropriateness of materials, since many students enrolled seemed to be reading far below the 7-9 grade level. There was mixed feeling as to the learning value of cognitive maps, "Terms to Know," and "Think About It" sections; 37 percent agreed to their value, 27 percent disagreed, and 35 percent were undecided or did not respond. Again, only 49 percent agreed that the cognitive maps helped students conceptualize and synthesize what they had read while 43 percent were undecided and 8 percent disagreed. The "Terms to Know" section appeared to be valuable (76 percent) in helping students to understand the material presented as did the "Think About It" sections which had a slightly lower level of acceptance, 65 percent agreeing and 14 percent disagreeing. Most teachers (89 percent) indicated that the concepts presented in the text were reinforced by associated laboratory activities and 76 percent believed that it was necessary for students to read the text and do laboratory activities to attain a good understanding of manufacturing technology. Only 33 percent felt that the readings were interesting to their students; 44 percent felt they were not. This is partially attributed to the low reading ability of many students taking the course.

3. Quality and Durability. Only 22 percent of the teachers felt the textbook binding, paper, and cover stock were adequate for school use on a continuous-use basis. This could be expected because the developmental materials were designed for only one year's use.

Appendix J contains copies of both the Construction and Manufacturing Questionnaires with all responses regarding instructional materials recorded as percentages. In addition, in Appendix J, teachers' ratings are recorded which indicate the degree to which the course objectives were judged to have been met.

Analysis of Supervisors' Questionnaire Concerning the Management of IACP

The number of requests by schools and school districts for descriptive information on procedures for initiating the IACP program seemed to warrant the development of a series of program installation guidelines. To obtain appropriate information, a questionnaire was developed and distributed to the directors of the six Field Evaluation Centers and the supervisors of the ten Demonstration Centers in January, 1971.

From the data gathered in this manner, the handbook, "Installing and Operating the IACP Program," evolved. Limited copies of this handbook can be obtained from the IACP staff.

The Supervisors' Questionnaire was organized so that information collected would be grouped under the following major headings:

1. Installation and Adoption
2. Public Relations
3. Equipment and Facilities
4. Budget
5. Teachers and Staff

These areas appeared to be the ones that would most often affect the working relationships of supervisors, coordinators, and consultants with school officials, teachers, the lay public, and industrially-related groups.

Questionnaire responses from the Field Evaluation Center directors and Demonstration Center supervisors were synthesized and analyzed by area. Responses were then summated under identified categories to determine trends in each area.

Installation and Adoption.

1. Respondents agreed that visiting an IACP program was important in gaining the support of school administrators in program adoption efforts. They also supported the development of an information handbook for the implementation of the IACP program. Important to directors and supervisors in this area were the following:

   a) Background and rationale of the IACP
   b) The instructional system
   c) The relationship of IACP to conventional industrial arts programs
   d) Program adoption procedures in schools and school districts
   e) Communication with administrators, teachers, parents, and professional and industrial groups
   f) Teacher preparation programs
   g) Facility, material, and supply problems
   h) Program budgets and costs
   i) Evaluation

2. Strategies suggested for use in implementing an IACP program included:

   a) Contact educational decision-makers for instructional programs and present an overview and explanation of the IACP program.
   b) Relate to decision makers the interest qualities, meaningfulness, and relevancy of the program content.
   c) Identify major program support from industries, associations, and other groups.
   d) Provide a clear, concise cost breakdown of the program.
   e) Consider teachers and teacher preparation programs.
   f) Share program with local professional, civic, and lay groups.

3. Principal among the problems faced by directors and supervisors in installing the IACP program were the following:

   a) Budget inadequacies to initiate the program
   b) Changing the image of industrial arts from a yesteryear program to one of current relevancy

c) Resistance of some teachers and administrators to change
d) Class scheduling problems
e) Identification, purchase, and delivery of materials and supplies needed
f) Teacher preparation

4. The two one-year courses of the IACP program appeared, as a time requirement, to offer problems for some respondents and not for others; the group was approximately equally divided on this question. Almost all of the directors and supervisors of Field Evaluation Center and Demonstration Center schools had adopted or were in the process of initiating action to adopt, one or both of the IACP courses as a regular part of their school's industrial arts curriculum. Two-thirds of the respondents believed the instructional sequence of "The World of Construction" was appropriate and should be continued in its present form. Others, reflecting some scheduling or student activity problems, suggested minor changes in the instructional sequence. Respondents indicated wide usage and correlation of IACP material with other subject areas; most frequently used and favored school organizational plan used by schools of the respondents was the 6-3-3 plan.

Public Relations.

1. Most directors of Field Evaluation Center schools and Demonstration Center supervisors chose a middle-of-the-road reaction to the amount of assistance one could expect from interested groups and persons. The area that appeared to offer the most assistance to the respondents was literature supplied by industrial and commercial firms and the publisher of IACP materials. A positive reaction was noted as directors and supervisors agreed that the IACP program had improved the professional image and relationship of their schools, teachers, and themselves. They also supported the thesis that supervisor-industrial relations and supervisor-parent relations had been improved as a result of the IACP program.

2. All respondents reported no known organized opposition to installation and operation of the IACP program. Assistance in installing the IACP program in schools and

school districts ran the gamut from the Associated General Contractors of America, various manufacturing associations, labor unions, and governmental agencies to local businesses in a community.

3. Relative to the adoption of the IACP program, questions most frequently asked of directors and supervisors by school administrators, teachers, parents, and industrial-related groups were the following:

    a) Cost of the IACP program compared to conventional industrial arts offerings
    b) Laboratory space needed
    c) The balance between laboratory and non-laboratory activities
    d) Reading level of IACP publications
    e) Relationship of IACP courses to conventional industrial arts courses at the junior high and senior high levels
    f) Availability of IACP teachers

Equipment and Facilities.

1. Directors and supervisors agreed that the major problem in this area for "The World of Construction" course was floor area and storage facilities. Most construction classes were offered in conventional woods facilities and because of this, woodworking machines and benches occupied floor area needed for construction activities. In many instances, directors and supervisors solved this problem by removing some machines and benches from facilities used for construction classes and transferring the equipment to other schools or to storage.

2. "The World of Manufacturing" course did not offer the same kind of floor area, storage, and machine or equipment problems found in its companion course (construction). In most cases, no major problems were experienced in offering manufacturing in conventional metals facilities, and it was found that each laboratory had machines and equipment which were not needed.

3. Most respondents found it necessary to purchase some new equipment and tools when initiating IACP programs. Most frequently mentioned in this general area were the following:

   a) Overhead projector and screen
   b) Assorted small hand tools to perform specialized tasks, e.g., cement finishing tools

Budget.

1. Field Evaluation Center directors and Demonstration Center supervisors agreed that to initiate the IACP program in their schools or school districts, some additional funds would be required. Estimates varied as to the amount of additional funds needed. Related factors were such items as:

   a) Quantity of books and laboratory manuals purchased, i.e., one set per class or one set per facility.
   b) Whether or not schools had an ample supply of overhead projectors, filmstrip projectors, and screens.
   c) Equipment, machines, and tools existing in shops to be used for IACP courses.
   d) Whether or not commercially made jigs, fixtures, apparatus, and teaching aids would be purchased or whether the teacher or school district would make their own.

   All Field Evaluation Center schools used a minimum of \$400 in additional funds to initiate both the construction and manufacturing courses. Although the amounts were moderate, most of these schools used additional funds to purchase first-time equipment and hand tools. Schools that offered IACP courses in conventionally equipped existing facilities and purchased all needed nonconsumable IACP materials from commercial sources, spent approximately \$3,000 per group of 125 students.

2. Plans varied from one extreme to the other among the Field Evaluation Center schools and the Demonstration Center schools with some schools buying very little commercially available IACP materials, others buying all materials from commercial sources.

Teachers and Staff.

1. Directors and supervisors agreed that IACP courses were more demanding on the part of teachers as well as of their own time. Estimates of lesson preparation time required of teachers ranged from three to ten hours per week. Respondents indicated laboratory assistants would be desirable for IACP teachers but indicated that exceptions should not be made for IACP teachers. It was indicated that all laboratory-type course teachers should be treated the same, both in preparation time made available during the school day and in regard to laboratory assistants.

2. Agreement was also in evidence on the question of need for additional educational preparation on the part of IACP teachers and supervisors. Mentioned most frequently were exposure to the IACP rationale, conceptual framework, instructional format, and teaching methods. Inservice programs, undergraduate and graduate courses, and summer workshops were mentioned as answers to this problem.

Analysis of Field Center Personnel Survey Regarding Involvement in IACP

This general questionnaire contained questions about personnel involvement in the IACP program during the developmental period. The questionnaire was administered to Field Evaluation Center and Demonstration Center supervisors and teachers during the final Mid-Year Evaluation Conference in 1971. The general section of the questionnaire dealt with the following topics: inservice training, classroom visitation, speaking engagements, reactions of other school personnel, class size, scheduling, facilities, comparisons to conventional industrial arts, problems with software and hardware developed by IACP, preparation time, and resistance to the program by administration, other teachers, students, and parents.

Summary of Results. In analyzing the questionnaire, some general statements or observations can be made:

1. The teachers felt that the inservice training sessions were necessary and provided adequate preparation for teaching the program. The same question was asked of the supervisors and, though they were not teaching in the classroom,

they felt that the sessions were beneficial in understanding and supervising the program.

2. When asked to react to questions about how involvement in IACP changed their relationship with other members of the profession, it was noted that laboratory visitations by other teachers increased greatly. Supervisors indicated an increase in attending and actively participating in professional meetings and an interest in more professional readings. In comparison, the teachers' responses also indicated increased change in this area but not to the extent of that of the supervisors.

3. One of the major areas for change was the increased number of speaking engagements or presentations given at professional meetings or to interested groups as a result of being involved in the IACP program. This has been a function of the supervisor in the area of public relations and at professional meetings, but all respondents reported an increase, the estimate of increase ranging from 100 to 500 percent. This was expected because of the leadership role assumed by the supervisor in local centers, but of special significance is the amount of contact that a large number of teachers experienced. Many who had never made presentations at professional meetings were now giving numerous presentations at local, state, and national meetings. Also, their active involvement with professional organizations from industry and civic groups was significantly increased. The teachers who were designated as head teachers indicated the greatest change and expressed excitement about the opportunity to conduct this service. Total numbers of presentations given by IACP Field Evaluation and Demonstration Center staff are difficult to determine, and the accounting of visitations to the classroom by interested parties was also so vast that it was difficult to accurately estimate numbers.

4. Another category of increased activity for both supervisors and teachers was the number of times they were asked to act as a consultant to other school systems. The supervisors showed a 100 to 400 percent change in this area and all respondents reported activity in this area. Some of the teachers became involved in

consultant work while others indicated no change since involvement in IACP.

5. How were the supervisors' and teachers' professional image strengthened in relation to their peers and publics in the local community? Nearly all respondents indicated that there was a noticeable change of attitude, especially on the part of the administrators and other teachers in their respective school buildings and local school districts. It was indicated that the image of the teacher was also strengthened with local industrial groups. A large majority of the teachers felt that IACP involvement strengthened their image with the students and parents; only one teacher reported that he felt it weakened his image.

6. The supervisors reported that an ideal and maximum number of students to be managed in a class should be 25 students. The teachers reported class size ranging from 17 to 40 students per class and an average of 5 classes each day. Space and time served to be the major reason why girls were not regularly scheduled into the IACP program. Some teachers reported that girls were enrolled, but when considering all the schools in the Field Evaluation and Demonstration Centers, the percentage was very small.

7. The length of periods that teachers had per day to present their lessons ranged from 40 to 58 minutes. About half of the teachers reported that the 45 minute allotment specified in the teacher's guide was enough time. The teachers reported the average of 2 hours a day was spent in preparation for teaching; the time ranged from 1/2 to 4 hours per day. Experienced IACP teachers spent less time for preparation than did the less experienced or new IACP teachers. Eighty percent of the teachers agreed that this time is justified as a part of their professional obligations, 10 percent were undecided, and only 10 percent disagreed. The teachers indicated that this is considerably more time for preparation than they spent when teaching conventional industrial arts.

8. The survey indicated that most of the laboratories in which IACP programs were implemented were either woodworking, metalworking, or a general shop. One

center reported using a vacant classroom. From this report one could assume that the IACP program is very flexible and that with some imagination and creative planning, a wide range of facilities could be adapted to implement the program. The wide range of size for rooms in which IACP programs were being taught was also reported as being flexible; they ranged from 1200 to 3600 square feet. Seventy percent of the teachers reported that they had sufficient space while 30 percent felt they could have used more space. Some of the major problem areas reported concerning facilities were: too many stationary work benches, heavy equipment permanently installed, need for more storage space, need for a lecture area, and the need for more electrical outlets than provided in the past.

9. Both supervisors and teachers agreed that it would be cheaper to plan a new facility to teach IACP than use a conventional general industrial arts laboratory, but responses varied when asked if supplies would cost less for IACP. Sixty-five percent of the supervisors and 47 percent of the teachers indicated the supplies would cost more for the IACP program. Thirty percent of the teachers felt it would cost less and 20 percent were undecided. The teachers' responses varied more than the supervisors' on this question.

10. To supplement the cost of implementing the program, about 50 percent of the Demonstration Centers reported some help from industrial sources. One of the Field Evaluation Centers received considerable support for materials and supplies. Others received financial support in the form of teacher scholarships to IACP workshops, while still others reported receiving encouragement and advisory support.

11. When asked to compare the IACP courses with conventional industrial arts courses with which they were familiar, supervisors and teachers, combined, rated the IACP courses as 68 percent excellent and 32 percent better than average. There were no responses of average, below average, or poor.

12. The questionnaire asked the supervisors and teachers to identify some of the major problems encountered during the developmental stages of the first three editions of the IACP materials.

The supervisors indicated that most of their problems dealt with the area of identifying a source and complete description of the supplies and materials needed to conduct some of the laboratory activities, and that the process of identifying the vendors was much more time-consuming than with the conventional program.

The teachers indicated the same concern as the supervisors about ordering supplies. When asked which piece of software caused the most problems, about 50 percent indicated the laboratory manual and 50 percent the textbook, but when asked which piece of software caused the students the most problems, 65 percent said the textbook. Ninety-eight percent of the teachers indicated that the jigs and fixtures caused them the most problems in respect to the special hardware that was developed; the same response was indicated when asked what piece of hardware caused the students the most problems.

All supervisors and teachers indicated that there was substantial improvement in the teaching materials as the program progressed through the three-year cycle.

13. The last question of the questionnaire asked the supervisors and teachers to respond to how the administration, other teachers, and students showed resistance to the program. The supervisors appeared to have encountered <u>some</u> resistance on the part of administrators and other teachers, while the majority of the teachers reported <u>none</u>. The only indication of <u>much</u> resistance was from the 17 percent of the teachers in regard to the students during the first year. One significant point that should be brought out is that all teachers reported that there was <u>no</u> resistance in all categories by the fourth year while supervisors were still reporting <u>some</u> resistance on the part of other teachers and students.

Survey of Construction Personnel Representing Management, Labor, and Education

The major objective of this survey was to gather external evaluation data concerning the opinions of a variety of substantive experts in construction regarding the fourth edition of "The World of Construction" instructional materials.

The questionnaire was mailed to 17 people and completed by 14 for a return of 82 percent. The participants' backgrounds were varied and included: contractors, labor union officials and staff, construction association officials, and university professors. Of the respondents, eight were involved in the development of the IACP instructional materials as writers or reviewers, and five were people in the construction industry who were very familiar with the instructional program and materials as used in the public schools. The following persons responded to the questionnaire:

Mr. Robert Briant, Director of Education and Training
New Jersey Heavy Highway and Construction Industry
Advancement Fund

Professor John D. Bristor
Architecture and Building Construction
University of Florida

Dr. Henry Daum, Director
Cherry Hill, New Jersey Industrial Advancement Program

Mr. Francis R. Dugan, President
Allied Construction Industries and
Dugan & Meyers Construction Company

Mr. Lonnie Gaither, Jr., International Organizer
Sheet Metal Workers International

Professor Laurence C. Gerkins
City and Regional Planning
The Ohio State University

Professor Narbey Khachaturian
Department of Civil Engineering
University of Illinois

Mr. Howard Knauf, Managing Director
Allied Construction Industries

Mr. L. Brent Kuhnle, Assistant Vice President
J. A. Jones Construction Co.

Mr. Bruce G. Martin, Assistant Executive Manager
National Roofing Contractors Association

Mr. William McSorley, Assistant to President
Building and Construction Trades Dept., AFL-CIO

Mr. David K. Reyes-Guerra, Guidance Director
Engineers Council for Professional Development

Mr. Kerry Rice, Director of Educational and Apprenticeship Program
Allied Construction Industries

Mr. Bruce R. Wellck, Assistant Director
Master Builders

The survey instrument consisted of two sections. The first section, IACP Construction-General Questionnaire, was designed to assess the value of the IACP construction course compared to conventional industrial arts offerings and the appropriateness of the content area for the curriculum, particularly at the junior high school level. The second section, IACP Construction-Textbook Questionnaire, consisted of nineteen questions designed to assess the organization, instructional quality, accuracy and comprehensiveness of the content; and the general design, quality, and durability of the textbook. Copies of the instruments and the results of the survey are included in Appendix K.

All 14 respondents completed the first section while 12 completed the second section of the questionnaire. In summarizing the data, responses of "Strongly Agree" and "Agree" were combined as one response -- "Agree" -- and likewise "Disagree" and "Strongly Disagree" were combined as one response -- "Disagree." Those responses of "Undecided" are reported separately.

Ninety-two percent of the respondents agreed that the IACP construction course would provide students with a more comprehensive understanding of the "world of work" and of the materials and practices used in the construction industry than they would attain in a

conventional program; and 86 percent agreed that they would be more knowledgeable about career and occupational opportunities. All respondents considered the course to be appropriate and worthwhile for secondary school children and 84 percent agreed that the program would be beneficial to junior high school children. Eighty-four percent also suggested that the program as such presents as accurate a picture of construction technology as it is possible to present in a school setting. Of all responses on the general questionnaire, the only disagreement registered related to the prior statement in which one person (7 percent) disagreed. Seventy-two percent of the participants agreed that students would have a good basic understanding of the use of hand and power tools while 28 percent were undecided.

In summarizing the section of the questionnaire that dealt with the textbook, again the responses were overwhelmingly favorable.

1. Organization. Complete agreement (100 percent) was recorded for the following characteristics of the textbooks: textbook organization which included an introduction, body of information, "Terms to Know" and "Think About It" questions; the type face and size; photographs and illustrations; and the organization of the table of contents and index. Only one respondent (9 percent) reported some disagreement in the area of the accuracy and completeness of the story and the sequence of the reading while 91 percent agreed and 9 percent were undecided about the completeness of the story.

2. Instruction. One-hundred percent of the respondents agreed that the material was up-to-date and accurate. They also agreed that the cognitive maps, "Terms to Know," and "Think About It" questions at the end of the chapters were accurately portrayed and represented an application of the important concepts in the text reading. Only one person (9 percent) disagreed that the text material presented the major practices used in present-day construction while 91 percent agreed that it did.

3. Quality and Durability. Ninety-one percent of the respondents agreed that the binding, paper, and cover stock were adequate and the design and appearance of the book was interesting and attractive, while one person (9 percent) was undecided.

A Review of Evaluation Reports from Demonstration Centers

To provide local educators with the freedom to base an evaluation of IACP on local objectives, no evaluation guidelines were proposed by the IACP headquarters staff. Consequently, the evaluation reports received from the Demonstration Centers varied in length and specificity, indirectly reflecting the size of the demonstration program and the school systems' facilities and staff available for program evaluation.

The length and specificity of the evaluation reports ranged from a one-page report to a comprehensive study prepared by an independent evaluation agency under a contract from a Demonstration Center. Some centers used designs involving statistical analysis in their studies, while others relied on subjective measures. Some Demonstration Centers developed their own evaluative instruments, while other centers used IACP-developed instruments only.

Most of the Demonstration Centers relied heavily on informal evaluations which included narrative descriptions, subjective appraisals of instructional program by teachers, administrators, students, and parents. In a few cases, evaluation data were collected by using student survey instruments, personal interviews with students and parents, school visitor surveys, and a student self-concept scale.

All centers had the option of using the following six evaluation instruments developed by the IACP: (1) achievement tests, (2) pupil questionnaires, (3) teacher questionnaires, (4) administrators' questionnaires, (5) parents' questionnaires, and (6) an attitude scale.

Most of the Demonstration Center personnel also participated in selected IACP evaluation activities. The discussion in this section, however, is limited to the "external" evaluation performed by the local school systems participating in the Demonstration Centers.

The following will summarize, compare, and reflect on the findings of the individual Demonstration Center evaluation reports as submitted to the headquarters staff. Copies of the original reports should be requested from the Demonstration Centers.

<u>While individual school systems identified problems and made suggestions for changing parts of the IACP, there appears to be no question about the success the IACP has had in the Demonstration Centers. In almost all reports, the principal comments focused on the acceptance and expansion of the IACP.</u>

While the criterion for success varied among the Demonstration Centers, there was a strong consensus that the IACP did provide a more comprehensive and systematic exposure to industrial technology than did previous industrial arts programs. But the success of the IACP was measured by more than this achievement.

The IACP gave industrial arts more exposure to the community than did previous industrial arts programs. The IACP, because of its structure, involved various community groups in many capacities and consequently created an atmosphere of involvement which did not exist before. Not only did individuals from business and community groups make a contribution to the program through this participation, but the association also served as a public relations vehicle. Many of the Demonstration Centers reported this as being extremely important in promoting industrial arts in the community as a whole. In a number of schools, it was pointed out that industrial arts had a negative image and that the IACP helped change this image to a positive one.

Student reaction to the program was very positive as measured by various questionnaires. In a number of Demonstration Centers, enrollment in industrial arts classes increased when the IACP was implemented. The instructional materials used in IACP were also used in other subject areas and provided for interaction between disciplines.

The textbook played a very vital part in many Demonstration Centers. While some schools reported that students found the textbook difficult to read (since students in the particular class or school were "poor" readers), other schools reported that the text greatly helped its poor readers increase their reading ability. In addition to its academic value, the text was hailed as an important public relations vehicle. Many centers reported that parents, for the first time, felt they knew what was happening in industrial arts classes and they greatly approved. (The textbook was kept at home for homework assignments by each student in most of the IACP programs.) The reading problem was partially solved in a number of ways, and the Demonstration Centers indicated potential solutions which would allow the below-grade-level reading student to benefit from the text's content. One center, for example, duplicated all the readings on audio-tape and each student had the choice of being introduced to the text material by listening to the reading, reading from the text, or a combination of both reading and listening. Another center used the reading material as subject matter for remedial reading classes; the text material was reduced to a lower grade-level by the remedial reading teachers. (It should be noted that the original IACP proposal called for dual grade-level text materials, one set of which would have been more appropriate for poor or non-readers. Monies for a modified edition of the text were not approved. The publisher of the commercial edition is aware of this problem and has attempted to simplify considerably the commercial edition.) One center, based on their findings, was critical of the IACP World of Manufacturing Comprehensive Examination. Their findings showed student gains which were substantially less than those found in the composite gains from other centers that were reported earlier in this chapter.

An analysis of the problems experienced by various Demonstration Centers usually revealed causes beyond the control of the IACP staff, causes which were the result of local policy. For example, some Demonstration Centers reported problems resulting from not having the necessary supplies at the needed time. This was almost always due to the local purchasing policies which delayed purchase and delivery and, consequently, disrupted IACP activities. It is extremely difficult to purchase all tools and materials for any new program during the regular purchasing period which generally occurs during the spring prior to the year in which the materials will be used. Some of the centers had additional problems because they did not initiate supply orders until the summer or autumn when school had already started. Those Demonstration Centers which had contingency funds from which the teachers could purchase supplies on a "demand" basis did not have the problems regarding the availability of supplies the other centers had. At least two school systems experienced school disruptions due to social unrest in the community and teacher strikes, and this apparently had some effect on the success of the IACP in those centers.

The extensiveness of the IACP orientation was another important aspect relating to the success Demonstration Centers had with the IACP, and is an activity which cannot be minimized in school systems thinking about implementing the IACP. Those school systems which followed the recommendations of the IACP staff regarding school and community orientation (including students, teachers, administrative staff, parents, and community leaders) experienced little difficulty during the year. At the orientation sessions it is important to identify and discuss potential problems teachers will encounter during the first year of operation, as well as the successes they will hopefully experience. The attitude that school systems had toward the required summer teacher orientation program held at The Ohio State University also had a bearing on the success of the program. Those school systems which financially supported their teachers at these sessions and considered this activity as part of their employment, had programs which enjoyed a greater degree of success than did school systems which left most of the financial responsibilities to individual teachers.

Educational programs require financial support. Those school systems which do not have adequate financial support for their programs, regardless of how little money one is speaking of, will subject their students, teachers, and administrators to needless frustration which often will result in negative attitudes toward the program.

Another activity related to the degree of success Demonstration Centers had with the IACP resulted from the amount of time they provided their teachers to prepare laboratories which were to be used for the IACP. A few school systems hired their teachers to work for a period before the fall semester officially began and this lead- or starting-up time enabled the IACP to begin with a minimum of problems.

Although the IACP was developed for 7th and 8th grade students, some of the Demonstration Centers used the material on the 9th and 10th grade levels. These centers, though indicating that the cognitive material was very appropriate for senior high school students, changed some of the laboratory activities to make them more meaningful for the more mature students. There is indication that the IACP is appropriate in learning situations other than the 7th and 8th grade levels.

The Demonstration Centers provided a great deal of visibility for the IACP, thus fulfilling a major objective of such centers. One center was the focus of an article which appeared in the Sunday magazine supplement in approximately 17 million newspapers throughout the United States. Another center reported that their IACP personnel taught IACP workshops in which 25 percent of the industrial arts teachers in the state participated and indications are that during the school year 1971-72, their inservice teacher preparation programs continue to expand. A third center's activity resulted in a newly created State Department position which provided funds to hire a consultant one-half time for the purpose of disseminating IACP information to school systems throughout the state.

If the criteria for the evaluation of Demonstration Centers are (1) credibility (demonstration of a trustworthy example of how the innovation operates under ordinary circumstances), (2) convenience (time and location for key change agents), and (3) critical assessment (providing a range and depth of information and experience about the innovation), then it appears from Demonstration Center feedback that the IACP fulfilled its objectives.

Summary

The evaluation activities of the IACP staff were designed to collect data that were considered useful in improving the instructional program and the total project effort. Although somewhat restricted by budget and manpower, numerous techniques and practices were implemented in order to perform a comprehensive evaluative effort. The information reported in this chapter is only a sampling of the evaluative practices and findings that are associated with the IACP. The evaluation chapters of this report, together with the other five chapters, form a complete story of the activities of the IACP. Unfortunately, a daily log was not kept to share with the profession the range and variety of reactions of administrators and teachers of the program. Video tapes were not produced of students working on daily lessons recording their enthusiasm, excitement, and frustration. Nevertheless, the data recorded and reported in this study do document the efficacy of the IACP system. The final evaluators will be the profession and the public.

CHAPTER V

DISSEMINATION ACTIVITIES

The objective of the dissemination procedure was to provide an opportunity for a greater number of schools, school systems, teachers, teacher educators, and interested citizens to learn about the Industrial Arts Curriculum Project instructional system. This dissemination was initiated through diffusion of information via brochures, articles in professional journals and trade publications, meetings, lectures, newsletters, correspondence, and the telephone; through the establishment of Field Evaluation and Demonstration Centers strategically located throughout the nation; and through the selection of a commercial publisher to assist with the improvement and diffusion of the curricular package.

Diffusion of Information

Several brochures were prepared by project staff beginning in 1966, pertaining to the Industrial Arts Curriculum Project. These brochures provided information pertinent to all facets of this newly developed program for the industrial arts curriculum. Well over 170,000 of the brochures were distributed throughout the country to inform as many people as possible of the importance and relevancy of the Industrial Arts Curriculum Project as an integral part of American education. Approximately 1,400 names were recorded on addressograph plates to facilitate the general mailing of project information.

As described in Chapter III, a handbook entitled "Installing and Operating IACP Programs" was developed. This handbook evolved out of the need of administrators and teachers for information and guidelines regarding strategy and problems related to the installation of IACP programs. Information used to develop the handbook was obtained from Field Evaluation Center and Demonstration Center personnel.

Countless numbers of presentations were made through personal appearances, visitations, and speeches at local, state, and national educational, industrial, and community conferences by the headquarters and Field Evaluation and Demonstration Center staffs. It would not be practical to list all of the associations and agencies to whom dissemination lectures were given; however, a few representative samples included the: (1) American Industrial Arts Association, (2) Governor's (Illinois) Advisory Council on Vocational Education, (3) Georgia

Industrial Arts Association, (4) Association for Supervision and Curriculum Development, (5) American Association of School Administrators, (6) Society of Manufacturing Engineers, (7) American Society of Civil Engineers, and (8) American Society of Engineering Education.

While it is virtually impossible to count the number of formal presentations given by the entire IACP staff, it is estimated that headquarters personnel made IACP program presentations 600-700 times over a five-year period. At all times, the IACP staff was prepared to offer information, formally or informally, to individuals or groups interested in learning about the nature of the IACP instructional program.

Field Evaluation Center personnel consisted of six directors, either teacher educators or local supervisors of industrial arts, and 48 teachers. An additional 34 men were involved in the Demonstration Centers. The personnel of both Field Evaluation Centers and Demonstration Centers continued to be the largest group of disseminators of information about the Industrial Arts Curriculum Project in their respective regions. IACP personnel were also involved with the production of dissemination materials including transparencies, slides, audiotapes, and displays that were used to improve communication of project activities to the profession and the public. Many of the audiovisual materials were shared with interested educators and industrialists for use in their professional activities.

In August, 1968, the first and only Industrial Arts Curriculum Project newsletter was published to disseminate knowledge pertaining to IACP throughout the country. This newsletter provided information of interest to both participants and nonparticipating individuals interested in IACP activities. Since project funds were not available to continue the publication of the newsletter, alternative forms of communication were created.

A great deal of time and effort was utilized in correspondence related to the project. The Intra-Staff Communication was initially published bi-weekly and later monthly, to keep field staff members informed about what was happening in Columbus and in the other IACP field centers. It was also a means of sending notices, directives, and helpful hints. This communication technique was also of value as a means of sharing personal accomplishments and activities of IACP personnel.

Other forms of dissemination information included letter and telephone conversations. The project staff received approximately 30 to 50 letters per week over a six-year period. Approximately 40-50 telephone calls per week were received by headquarters staff during the same period of time. These figures appear to be conservative estimates of these two kinds of dissemination activities. Also, it is reasonable to assume that based on feedback from Field Evaluation and Demonstration Centers the above figures would have more than doubled if all IACP staff (field and headquarters) activity had been tabulated.

Most of the correspondence requested information pertaining to availablity of materials, daily business activities, field center problems, preparation of teachers, evaluation and supportive data, scheduling, and so forth. Letters and telephone calls were received from people interested in the project, including parents, public officials, industrialists, labor leaders, administrators of city school systems throughout the country, college and university administrators, teachers, teacher educators, and participating staff members of the IACP program.

To help increase community awareness in the field centers, letters were sent to parents describing their children's involvement in this innovative industrial arts program. Parents became more informed about the program, as indicated by parental feedback, and were well pleased with what their children were studying about industry. Parents learned about IACP from the printed dissemination materials, by reviewing their children's instructional software, by visiting the classes, and by attending open-house activities and PTA meetings.

Although IACP materials had been extensively tested in the Field Evaluation Centers, it was not until 1969 that the materials were publicized extensively on a national basis. After that time, dissemination information appeared in the form of many articles published in magazines, professional and trade journals, and newspapers, a few of which were: Industrial Arts and Vocational Education, School Shop, Bulletins of The Associated General Contractors of America, School Management, Engineering News-Record, Nation's Schools, The Journal of Industrial Arts Education, Parade Magazine (supplement to many large newspapers), Civil Engineering, California Industry, and The Ohio State University Monthly Bulletin.

The McKnight & McKnight Publishing Company has been a major contributor of advertisements and of dissemination information for the Industrial Arts Curriculum Project since their selection as the exclusive publishers of all IACP materials in December, 1969. Publications prepared by McKnight & McKnight describing the IACP program and materials can be obtained by writing to the publisher.

Field Demonstration Centers

The 1968 amendments to the Vocational Education Act of 1963 authorized states to assist communities in conducting vocational education programs for persons of all ages. Included in this authorization were programs of occupational orientation for the junior high school level. Since occupational orientation was perceived as one outcome of the IACP, the project staff, during the spring of 1969, organized the IACP to make it available to schools who were interested in pilot testing the program. This phase of the IACP dissemination activity was known as the Field Demonstration Center Program and consisted of school systems called Demonstration Centers.

To help local school systems participate in this dissemination phase of IACP, a model proposal was prepared to assist school systems to obtain occupational education funds from state departments to support the pilot testing of innovative programs. It should be noted, however, that several school systems decided to initiate demonstration programs totally supported by local funds. In one center, a major industrial corporation provided a significant share of the financial support of the program.

The reasons for establishing Demonstration Centers were to permit schools to use, to review objectively, and to evaluate the work and potential of the IACP in a setting independent of the IACP staff and to establish IACP model programs in as many states as possible. A greater number of geographically dispersed centers also provided more information for educators, thus assisting them in determining how the IACP could be adapted to meet the educational needs of the citizens of each state.

Specific goals of the Demonstration Program were:

1. To provide an objective setting for educators and interested community representatives of a state to assess the applicability of IACP to their educational system.

2. To allow local school personnel the freedom to develop and coordinate their own evaluative system and instruments. Such evaluation practices would evaluate the IACP program according to the needs of local school systems and provide "external" evaluation data to the IACP.

3. To encourage teacher educators to become familiar with the instructional system through participation in the Demonstration Program so that adequate plans could be made for preservice and inservice teacher education to meet local demands for IACP teachers.

While the responsibilities given the Demonstration Centers by the IACP staff were minimized, certain standards had to be met by participating schools. These standards included:

A. Teachers

1. Interested in and committed to change in industrial arts.
2. Teaching junior high school or equivalent classes.
3. Willing to participate in a four-week teacher preparation program at The Ohio State University during the summer preceding the start of the IACP in their school (summer of 1969 or 1970).

B. Schools

1. Offering a full year of industrial arts for students enrolled in the Demonstration Program.
2. Scheduling instruction time to include a minimum of five forty-five minute periods or the equivalent per week.
3. Scheduling participating teachers with a maximum of five class periods per day.

Each Demonstration Center was encouraged to create an advisory committee to provide guidance for the local IACP program. From experience with Field Evaluation Centers, it was found that individuals from the ranks of labor and management provided not only valuable guidance, but also personal time, financial assistance, and industrial materials for the support of local programs.

The following ten steps will help to illustrate the general procedures and guidelines used by school systems to establish a Demonstration Center.

1. General orientation to IACP by project representative to interested group (educators, administrators, board of education, community groups)

Spring prior to demonstration year

2. Decision by board of education (or other decision-making body) to participate in IACP

   Spring prior to demonstration year

3. Identification of IACP teachers and schools

   Spring prior to demonstration year

4. Orientation of student body to IACP

   Spring prior to demonstration year

5. Teacher preparation

   Summer prior to demonstration year

6. PROGRAM BEGINS

7. Formation of local advisory committee

   Prior to or during demonstration year

8. Periodic meetings of all instructional and administrative staff involved in demonstration program

   During demonstration year

9. IACP staff visits (4 per year)

   During demonstration year

10. Program evaluation

    During demonstration year

Seven Demonstration Centers (Figure 18) were in operation during the 1969-70 school year; this number increased to thirteen (Figure 19) during 1970-71. The IACP program was demonstrated in a variety of settings so that the vast organizational and operational differences provided educators with the opportunity to examine the IACP under normal and diverse conditions. For example, in the Urbana, Illinois Center, the IACP instructional program was in the University High School industrial arts program (an experimental laboratory setting). Administratively, this center was a one-teacher, one-class operation

DEMONSTRATION CENTERS
1969-70

School System	Number of teachers	Number of schools	Number of classes	Total number of pupils
University of Illinois High School Urbana, Illinois	1	1	1	15
School District of the City of Pontiac Michigan	3	3	15	275
Washoe County School District Reno, Nevada	1	2	5	125
Newark Public Schools New Jersey	5	2	16	420
Columbus Public Schools Ohio	2	1	10	250
Parma Public Schools Ohio	5	5	5	130
Pittsburgh Public Schools Pennsylvania	1	1	2	50

FIGURE 18

DEMONSTRATION CENTERS
1970-71

School system	Number of teachers	Number of schools	Number of classes	Total number of pupils
Naperville Public Schools Illinois	3	2	15	400
Shawnee Mission Public Schools Kansas	2	1	10	250
School District of the City of Pontiac Michigan	9	5	45	1000
Minneapolis Public Schools Minneapolis	2	1	10	250
Washoe County School District Reno, Nevada	3	3	10	260
Newark Public Schools New Jersey	5	2	16	420
Columbus Public Schools Ohio	2	1	10	240
Worthington Public Schools Ohio	2	2	20	550
Pittsburgh Public Schools Pennsylvania	7	6	18	250
Prince William County Schools Virginia	2	2	10	200
Robert F. Kennedy Youth Center West Virginia	2	1	N.A.*	200

FIGURE 19

and involved students who were generally above average in reading ability and previous academic exposure. The Robert F. Kennedy Center is an experimental federal penal institution not having a class schedule normally found in the public schools. Student inmates worked on a monetary incentive basis and were allowed to complete the program in a much shorter period of time than one school year. In another center, educationally handicapped students were placed in IACP classes with other students. The evaluation report from that center indicates that the educationally handicapped students worked successfully in the program and achieved more information and skills during their year of IACP participation than they had in previous years. Some centers consisted of one-teacher situations in public schools while others involved an entire "team" including teachers, head teachers, supervision, and a teacher educator.

It should be noted that no 1969-70 Demonstration Center dropped the IACP because of program inadequacy. The two 1969-70 centers which did not participate in the 1970-71 program did so because of financial and programming problems affecting their entire school program. What is important, is that every other 1969-70 center expanded its IACP offering in 1970-71 and it appears that all thirteen 1970-71 centers will continue with or expand the IACP program after the termination of the demonstration period. (See Figure 20.)

A summary of the evaluation reports prepared by Demonstration Centers may be found in Chapter IV. These data were helpful in providing an external evaluation of the IACP.

Commercial Publication of the Materials

Throughout the development of the IACP, the administrative staff held the conviction that the curriculum materials produced would have broad national potential for secondary school industrial arts programs. It was felt that a realization of this potential would depend upon effective publication and distribution which included the capability for:

1. Producing and revising the materials
2. Promoting and advertising the materials
3. Packaging and distributing the materials
4. Developing teacher preparation programs and providing installation services in the schools

DEMONSTRATION CENTERS

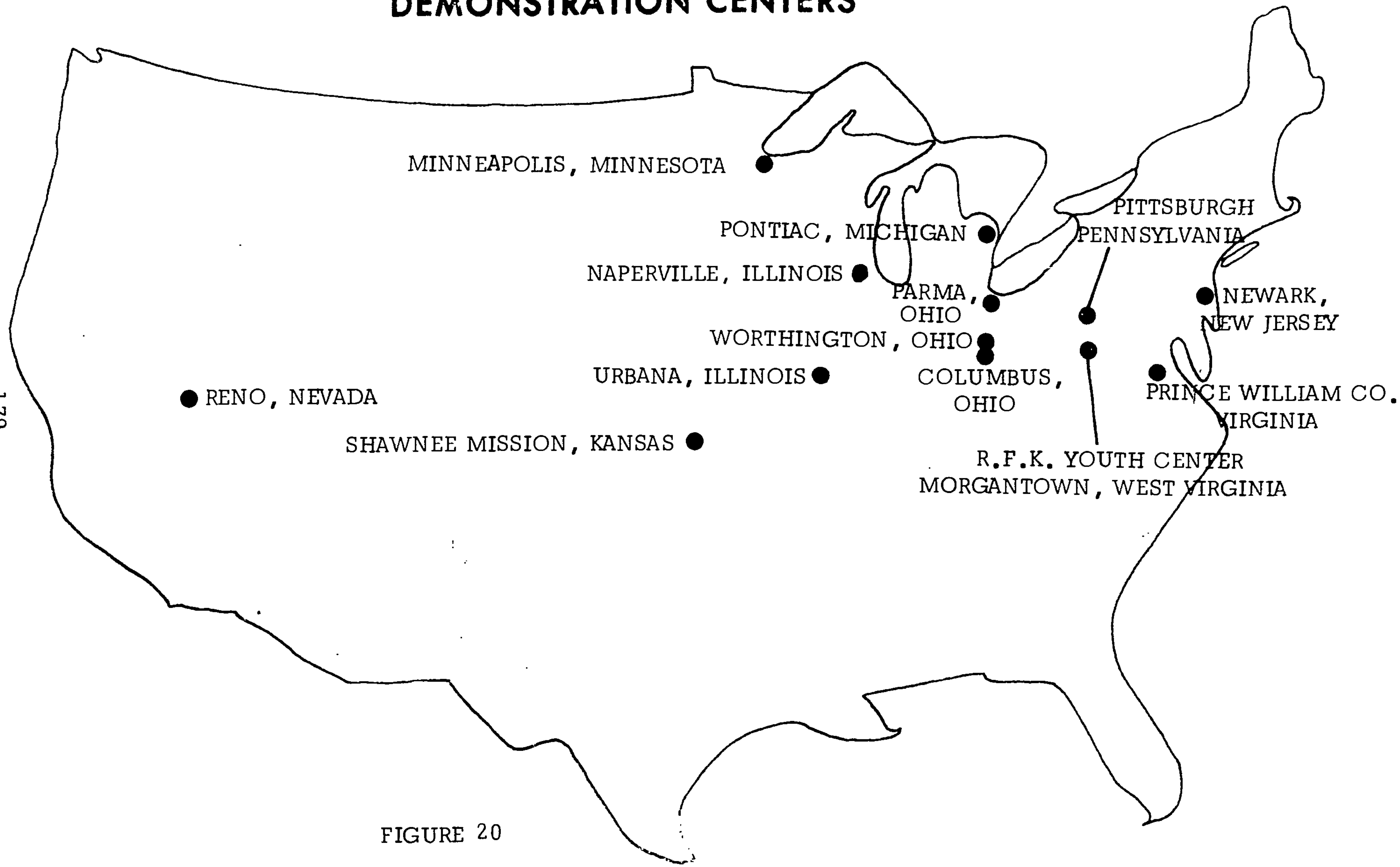


FIGURE 20

Selection of a Publisher

The IACP administrative staff took the position that widespread and successful adoption of these materials could be accomplished only through the efforts of a major textbook publisher experienced in the publication and promotion of secondary school curriculum materials. Using these criteria as a guide, eighteen publishers considered to be qualified in this area were surveyed to determine their interest in publishing and promoting the IACP package. None of the responding publishers indicated a willingness to publish the materials as developed if they were to be placed in the public domain. Seven responding publishers did, however, express an interest in competing for the rights to publish the material as developed if they could be made available with copyright protection.

Therefore, permission was requested by The Ohio State University Research Foundation to copyright the two-year sequential materials of the Industrial Arts Curriculum Project, "The World of Construction" and "The World of Manufacturing," with copyright protection for a limited period of five years. In the opinion of the central project staff, the suggested five-year limited copyright protection would:

1. Provide the publisher with the incentive to invest appropriate money and effort in the production and dissemination of the curriculum materials.

2. Provide the incentive to the publisher to develop necessary evaluation and feedback mechanisms to allow an opportunity for at least one revision of the curriculum materials.

A "Briefing Conference for Publishers" was held in September, 1969, to provide prospective publishers with background information on:

1. The philosophy and approach of IACP.
2. The nature and content of curriculum materials to be published.
3. The evaluation of the IACP instructional system.
4. Guidelines for proposal preparation and criteria for proposal evaluation.

Seven of the eighteen publishers previously contacted expressed an interest in attending the briefing conference. The remaining eleven publishers were also apprised of the conference and given the opportunity to attend. On September 22, 1969, the publishers' briefing conference was held with representatives of seven companies in attendance. At the briefing, four major items were discussed. These included:

1. The materials to be published.
   a) Basic Materials
      Textbook, Laboratory Manual, and Teacher's Guide
   b) Ancillary Printed Materials
      Overhead projectuals, filmstrips, achievement tests, and miscellaneous printed materials
   c) Laboratory and Demonstration Materials
      Devices and supplies unique to the program

2. The proposal format and guidelines.
3. The proposal submission deadline of Friday, November 21, 1969.
4. The evaluation procedures.

The submitted proposals were presented to a review subcommittee of the IACP National Advisory Committee. This subcommittee ranked the proposals and made its recommendations to the project Co-Directors. The project headquarters staff also evaluated the proposals. The recommendations of the staff and Advisory Committee were transmitted by the project Co-Directors to the grantee (The Ohio State University Research Foundation) for submission to the U.S. Commissioner of Education.

The involved publishers were notified by the grantee of the action taken by the Commissioner on December 15, 1969. Contractual arrangements with the grantee and the selected publisher, the McKnight & McKnight Publishing Company, were made in December, 1969 and January, 1970.

Contributions of the Publisher

The McKnight & McKnight Publishing Company was awarded exclusive publication rights of the IACP instructional materials through a five-year limited copyright contract. The company was selected by a subcommittee of the National Advisory Committee which reviewed all submitted proposals. McKnight & McKnight was selected because, among other things, it specializes in industrial arts and vocational education publications, its representatives make over 4,000 sales calls and attend more than 200 exhibits in the field of industrial education annually, and the company's involvement with the American Council on Industrial Arts Teacher Education Yearbook Committee and with industrial arts teacher educators throughout the country puts them in close contact with almost every trend in industrial education curriculum development. Early in 1970, McKnight & McKnight published a book, Innovative Programs in Industrial Education, which represented a formal summary of more than two dozen curriculum development projects. The company has been a recognized leader in program innovations in industrial education.

Since the USOE released its national survey of industrial arts education in 1966, the McKnight & McKnight Publishing Company has spent considerable time analyzing the data presented in the report. These data very clearly showed that the largest single market for industrial arts instructional materials is the general industrial arts course. For the most part, its enrollments are concentrated in grades 7-9.

By September, 1969, the McKnight & McKnight Publishing Company had reviewed early developmental editions of the IACP materials and were generally aware that a field test network had been established. The company felt that, in terms of field testing and preparation of an instructional system, the IACP curriculum development activity had progressed significantly farther than other curriculum developments. The company perceived that there was an extremely good "fit" between the IACP courses and the general industrial arts market.

The following five sections were produced cooperatively between the central staff of the Industrial Arts Curriculum Project and the McKnight & McKnight Publishing Company for the purpose of providing a narrative record of the company's involvement in the curriculum development and dissemination efforts of the IACP.

Procedures Utilized in Analyzing IACP Potential and Preparing a Proposal. The September 22, 1969 briefing conference turned out to be a significant and pivotal event for the McKnight & McKnight Publishing Company. Four key facts were brought out at the conference.

1. It was critically important to the success of the project and to a publisher's proposal to be able to deliver

commercial quality, fourth edition, "The World of Construction" materials for September, 1970 classes.

2. It was clear that in addition to the educational viability of the instructional systems which it had developed, the project's features also included significant and important intangible resources, i.e., a comprehensive and carefully developed relationship with influential industry groups, a developed internal efficiency, skill in managing by objectives, and problem solving.

3. Field test center schools, which had tried the program in detail, were sufficiently satisfied with the product so that it appeared they would adopt it on a permanent system-wide basis.

4. Emphasis was placed on the importance and place of the teacher education function in the operational and marketing success of the IACP courses.

In the weeks following the briefing conference, the company's attention was directed to six tasks and analyses.

1. Analyzing the resources they would need to commit in order to achieve September, 1970 production objectives.

2. Projecting the future adoption plans of the Field Evaluation and Demonstration Center schools to estimate the first-year market and project future adoption expectations for the schools.

3. Analyzing and projecting realistically the potential future market for IACP courses.

4. Analyzing and projecting the profitability and cash-flow of resources necessary to generate them.

5. Fitting the data gathered into the corporate objectives and strategies to determine the feasibility of assigning necessary resources to the IACP.

6. Evaluating and weighing the criteria for success as it was felt it would be perceived by persons reviewing their proposal.

Production Objectives, Concepts, and Strategies. The McKnight & McKnight Publishing Company production objectives for the Industrial Arts Curriculum Project were oriented to "The World of Construction," since this program had the shortest lead-time and had to be accomplished during the same time that many other supplier relationships and marketing functions were being served.

The company recognized the inputs that were required for each function in the production of "The World of Construction" materials, and thus established productivity objectives, and detailed schedules. They obtained scheduling commitments from suppliers that were consistent with the achievement of the objectives. They also developed contingency plans that would become effective in the unanticipated event of nonperformance by any of the parties involved in the production program, and committed themselves to do whatever was necessary to insure that the IACP could maintain its own commitments to the Field Evaluation and Demonstration Centers to continue their programs. Finally, in order to increase their chances of achieving production objectives in the event they were selected as the publisher, the McKnight & McKnight Publishing Company speculatively began several preproduction operations (permissions requests, illustration improvement, reading-level reduction) in October and November, 1969, or approximately one to two months before selection of the publisher was to be made.

Marketing Objectives, Concepts, and Strategies. The first-year marketing strategy, beginning on the Day of Award, was to establish as many new "World of Construction" Demonstration Centers as could adequately be served by the 1970 summer teacher training workshops and supported by August, 1970 software and hardware deliveries.

With congressional support for educational appropriations and with significant financial support from labor and management in potential Demonstration Centers, additional "World of Construction" pilot programs were established for the fall 1970 operation.

A significantly important component of the first-year marketing program was the utilization of IACP headquarters staff, Field Evaluation Center directors, and IACP teachers in making presentations to administrators, industry groups, and industrial arts supervisors and teachers in nearly every major metropolitan area in the country.

By the fall of 1970, "The World of Construction" program was used by approximately 15,000 students, in 200 laboratories in 100 school systems in 33 states. Pilot programs were operating in 30 of the 40 largest metropolitan areas of the country.

By the fall of 1971, it is estimated that approximately 30,000 additional students will be involved in "The World of Construction" and 15,000 in "The World of Manufacturing," giving a total of approximately 60,000 students taking the two courses in the 1971-72 school year. This will involve some additional 340 laboratories and be extended to nearly all the states.

These favorable results were achieved under the following disadvantageous circumstances: (1) 1970 was a very poor year for the federal funding of educational innovations, and (2) many school districts were under financial pressures that significantly reduced their willingness to consider innovations that involved additional expenditures. The IACP schedule did not permit selection of the publisher until the very end of 1969, when many school districts had already completed their preliminary 1970-71 budgets. Despite the favorable reactions which had been generated by the field test program, educational decision-makers were not generally aware of the nature and scope of the project and its two courses.

The first-year sale of "The World of Construction" software to individuals and others in interested nonclassroom markets was approximately 2,000 Textbooks and 500 Laboratory Manuals and Teacher's Guides.

Year-Five Market Share Objectives: Prime Market. In the future, the major objective will be to maximize the number of students annually involved in IACP programs. For the prime market, this objective is best stated in terms of market share. The major objective of the McKnight & McKnight Publishing Company will be to achieve a 25 percent market share for "The World of Construction" by fall 1974. At this level of market penetration, 500,000 boys will be involved in the program annually. The projected goal for "The World of Manufacturing" is 375,000 students, approximately 15 percent of the market.

Objectives for Market Penetration and Future Development. Initially, most of the development activities will be oriented toward making improvements in the instructional materials that are suggested by feedback provided by pilot programs and other users who adopt IACP without a close relationship with the project staff.

Secondly, various kinds of additional services and products that will help utilize the existing instructional materials more efficiently will be analyzed.

In addition, feedback suggesting alternative formats for the IACP courses, particularly ways in which they can be adapted to fit different product configurations and different time schedules, is being audited. The company does not think it necessary to interject these kinds of situations merely to make it easier for potential users to avoid making hard decisions. The IACP program has enough educational value and marketing thrust that this is not necessary. The company does plan, however, in cooperation with the IACP staff, to adopt features and/or segments of the instructional materials so that they meet varying sets of objectives that may be held by groups of potential users.

The McKnight & McKnight Company has made minor changes in "The World of Construction" materials based on feedback collected by the project staff and interested construction teachers for the second printing of the commercial edition. The publisher will perform the same task with "The World of Manufacturing" materials.

Summary

A variety of techniques and practices were used to disseminate information about the IACP. Field center and headquarters personnel were called upon to give presentations at local, state, and national conferences. Lectures and audio-visual presentations were supplemented with numerous staff-developed articles and brochures. In addition, a number of industrial groups also developed IACP-related articles and brochures and sponsored descriptive presentations on the IACP at their meetings and conventions. Now that the IACP instructional materials are commercially available, the publisher has assumed a leadership role in diffusing information to agents of educational change.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This final report has been prepared so that information concerning the goals, administration, research, development, evaluation, and dissemination of the Industrial Arts Curriculum Project can be made available to interested governmental agencies, educational institutions, and individuals concerned with educational change.

The availability of USOE funding enabled the Academic Faculty of Industrial Technology Education at The Ohio State University, in cooperation with faculty from the University of Illinois, to provide leadership for conceiving and developing a complete teaching-learning support system. Curriculum materials and teaching-learning strategies were designed, engineered, tested, and integrated into an instructional system. Personnel from many elements of the academic community, business, and industry (management and organized labor) helped to make the instructional package authentic and relevant to contemporary industrial practice. In addition, substantial financial support was provided by Chapters of the Associated General Contractors of America, the Society of Manufacturing Engineers, and several International Unions of the AFL-CIO.

This report was an attempt to summarize the problems and accomplishments of the IACP from its inception on June 1, 1965 to the termination of the project on August 31, 1971. The foregoing commentary is substantiated by documentation showing that all of the overarching goals were achieved. As a concluding narration, this section will list the major objectives and briefly review the evidence that supports their successful completion.

Conclusions

Accomplishment of Objectives

Objective No. 1: Conceptualization of a Structure of Knowledge in the Field of Industrial Arts. A comprehensive analysis of the literature and preparation of an annotated bibliography served as the initial step. This was followed by the development of a set of criteria for determining a structure. Criteria dealing with scope, limitations, and sequence were initiated, and a working paper on the structure of content was drafted. Consultants from various academic disciplines together with those from industrial management, labor, and business assisted in these tasks.

The formulation of Task Force working groups was the next input. Members of these groups were drawn from selected substantive areas of industry. These groups met and further identified the concepts and principles within the structure.

The project staff next prepared a revised manuscript and submitted it to approximately 100 leaders in education for their reactions. Their input was utilized to prepare the final copy of the rationale for the IACP.

The major outcome of this objective was the 382-page volume entitled A Rationale and Structure of Industrial Arts Subject Matter (Towers, Lux, and Ray, 1966). The document stands as the only comprehensive undertaking of this kind in the field of industrial arts education.

Objective No. 2: Development of a Syllabus for Industrial Arts. In order to complete this objective, it was first necessary to identify the criteria to be used in developing the syllabus. Guidelines focused on six factors:

1. The structure of the body of knowledge
2. Desired behavioral changes
3. Nature of the learner
4. School facilities and materials
5. Instructional procedures and materials
6. Measurement and evaluation

Under these criteria, a conference group was organized to develop general objectives of the program. The criteria and objectives served as a referent for structuring the teaching-learning components for a two-year curriculum sequence. As sections of the program were completed, over an eighteen month period, they were submitted to the National Advisory Committee and modified.

The next step consisted of a series of conferences which resulted in a detailed outline of the reading assignments. Throughout this process, numerous consultants were used from the substantive areas of construction, manufacturing, and educational methodology.

The successful achievement of this objective served as the basis for the following objective.

Objective No. 3: Production of a Package of Teaching Materials. The initial effort toward the achievement of this objective was a preliminary pilot study. The concept "Interchangeability of Parts" was selected. Based on this concept, curriculum materials and an instructional system package were invented, field tested, and evaluated. From this, insight was gained into the problems and procedures for generating instructional materials and managing activities in test centers. Estimates were made as to costs, time requirements, personnel requirements, materials, and procedures.

Based on this information, a PERT analysis was developed for the period from December, 1966 through August, 1971. A major thrust of this time period was the development of an instructional system.

Utilizing the knowledge base established through the development of the rationale and structure of industrial technology, "The World of Construction" was invented, designed, constructed, and assembled in the period from January, 1967 through November, 1967. Also, the initial development of "The World of Manufacturing" was begun, and the first edition of the manufacturing instructional system was completed by November, 1968.

These two instructional programs were the major input to the completion of the following objective.

Objective No. 4: Field Testing and Revision of Teaching Materials. Following the initial development of the instructional system, a field testing program, based on two questions, was planned and made operational:

1. What information is needed by the curriculum decision-makers in order to make intelligent decisions regarding program revisions?

2. How can the required information be obtained?

As a next step, a strategy was identified with which to evaluate the instructional system (textbook, laboratory manuals, teacher's guide, hardware, instructional format, teaching methods, laboratory activities, evaluation procedures, etc.).

1. Formative Evaluation. The quality control plan for the program elements during their initial development and subsequent revisions.

2. Summative Evaluation. The determination of whether the program elements provided a valid solution to the attainment of the educational specifications.

3. Intraschool Evaluation. The collection and analysis of data and procedures to aid educational decision-makers regarding the adequacy of the instructional program for local adoption.

A network of Field Evaluation Centers was next established across the United States for the field testing. For the 1968-69 school year, this network totaled six Field Evaluation Centers consisting of 24 schools, 48 teachers, and approximately 5,000 students.

The outcome of the three-year field testing and revision cycle, based on the rationale, syllabus, and program development, was an instructional system consisting of software and hardware entitled "The World of Construction" and "The World of Manufacturing." These materials are currently available in a fourth edition (first commercial edition).

Objective No. 5: Dissemination and Field Promotion of Teaching Materials. To create a widespread awareness of the research and development progress efforts of the IACP, several lines of communication were used. Included were articles in periodicals, presentations for interested publics, conferences, brochures and pamphlets, newsletters, and personal correspondence.

In addition, Field Demonstration Centers were established to use and evaluate the IACP materials, in third edition, one year prior to commercial availability. These programs provided an opportunity to determine how schools adopt and adapt the IACP program to meet local educational and social needs, without the restrictions imposed upon the Field Evaluation Center programs. Also, demonstration programs provided additional prepublication dissemination concerning the IACP.

The dissemination of the first commercially available IACP product, "The World of Construction" software and hardware, was undertaken in December, 1969 as a combined effort of the IACP staff and the McKnight & McKnight Publishing Company, upon the award of a limited five-year copyright contract. The copyright is held by the OSU Research Foundation. Since that date, about 160 additional school systems have adopted the program, increasing the enrollment in "The World of Construction" to approximately 45,000 students, in 540 laboratories in school systems in nearly every state. The enrollment projected by the McKnight &

McKnight Publishing Company in "The World of Construction" and "The World of Manufacturing," by the 1974-75 school year, will be nearly a million boys and girls. This figure accounts for approximately one-third of the existing market.

Objective No. 6: Development of Teacher Education Programs. An undergraduate program to prepare teachers of industrial technology was begun at The Ohio State University in the autumn of 1968. Some of the students in this program were supported by a scholarship program established by a national labor-management organization. A new undergraduate curriculum was designed to provide teachers with a background of knowledge in modern construction and manufacturing technology.

The McKnight & McKnight Publishing Company, in cooperation with IACP, established a geographic network of teacher education workshops in 16 educational institutions to prepare more than 500 construction teachers during the summer of 1970. This network of teacher education workshops experienced phenomenal growth during the 1971 summer school period with 45 colleges and universities offering 72 workshops in construction and manufacturing. The 1971 workshop groups were functioning in industrial arts teacher education institutions, in 28 states and in Canada, with an estimated 1,900 participants. The geographical spread of these institutions was from Florida State University in Tallahassee to the University of Alaska in Fairbanks, and from the University of New Brunswick, in Canada, to California State College at Long Beach.

Impact of the IACP on Philosophy and Image

The Industrial Arts Curriculum Project has been the largest, most extensive curriculum development and dissemination effort ever undertaken in industrial arts education. The project has provided new insights into curriculum development efforts by involving, as active participants of the curriculum development team, representatives from business, industry (management and labor) and education, both within and outside the field of industrial arts education. The rationale has provided a new base for generating a logical, meaningful, relevant instructional program which reflects contemporary industry. The curriculum structure represented a major shift in curriculum foundations--from a traditional trade and job analysis base to a praxiological (efficient action) knowledge base.

The philosophy and objectives of industrial arts education have been general knowledge for years, but educational administrators as well as industrial arts personnel recognized that this philosophy and these objectives had not been implemented or achieved. To be sure, accomplishments within conventional industrial arts programs could be pointed to as evidence of achieving many of these objectives but, in the main, industrial arts could not claim to have a cohesive, comprehensive, and internally consistent framework from which youth could draw meaningful insights into that complex and productive societal enterprise - modern industry. The IACP program has brought system and order to the many diverse parts of contemporary industry.

New horizons have emerged for field center directors and industrial arts teachers, as a result of their involvement in IACP evaluation and dissemination activities. Nationwide contacts with educators and representatives from industry have evolved during the IACP development and field evaluation cycle. For some, a greater range of innovative curricular development and evaluation procedures became a part of their background of experiences. A new rationale and structure for the teaching of industrial arts was assimilated by the group.

Since the inception of the IACP, and through its over six years of development and field testing, the rationale and structure of industrial arts subject matter has been the center of much discussion, and it has served as the impetus of a formidable challenge to the direction and philosophy of conventional industrial arts programs. The IACP publication, A Rationale and Structure for Industrial Arts Subject Matter, has served as a guide for upgrading instructional programs and for making their content more relevant to 20th-century industrial technology.

The image of industrial arts has been upgraded in the eyes of educators, within and without the discipline of industrial arts as well as with the lay public and industry, as a result of the development of an internally consistent, defensible structure for industrial arts education that truly reflects contemporary industry in the school classroom or laboratory.

This new plateau of educational significance is attested to by this sampling of opinions from related interest groups:

Educational Administrators. It appears that industrial arts education is truly on the threshold of making the significant contribution to the education of all boys and girls that it is capable of making, and it soon may be taking a recognized and essential place among other secondary school disciplines.

Field Evaluation Center Directors. The background, rationale, structure, course content, and teaching methods of the IACP program have resulted in increased understanding by youth of the man-made world and of the world of work, and in enlightened citizenship and more adequate educational-vocational guidance.

Industrial Arts Teachers. For the first time, according to many IACP teachers, they recognized significant and meaningful learning taking place in their students. In addition, most IACP teachers reported tremendous personal satisfaction from the contribution they were making to the education of boys and girls. The philosophy, rationale, and content of IACP courses had made "believers" out of most IACP teachers; so much so that they indicated they would not like to return to teaching conventional industrial arts courses even though, admittedly, they had to work harder than usual.

Other Teachers. Teachers outside the field of industrial arts education also proved to be active boosters of IACP courses. The image of the discipline improved among non-industrial arts teachers, as school principals encouraged them to pattern their lessons after the behaviorally stated content of IACP courses. Other evidence of a new stature for the program came as schools voted to grant the same weight to IACP course credit as that afforded academic subjects, when consideration was given to recognition of students in the National Honor Society.

Parents. As a group, parents recognized a change and an improvement in the image of industrial arts education. In IACP courses, they found industry as one of the most pervasive and dominant elements of our culture. They noticed that learning activities shifted from an emphasis on skill exercises and related information, in a few selected trades, to an understanding of the nature of industry, its materials, processes, and organization. The image and value of industrial arts education shot upward as parents recognized that their children were gaining more cultural awareness of industry in the "new" industrial arts than most adults acquired in a lifetime.

Teacher Educators from Cooperating Colleges and Universities. Prospective and experienced teachers look to colleges and universities for professional leadership and direction in synthesizing and evaluating innovative ideas in the field of industrial arts education. To this end, forty-five colleges and universities offered 72 IACP workshops in 28 states and Canada during the summer of 1971. An estimated 1,900 teachers sought improvement in these workshops where the opportunity to stay abreast of innovative curriculum developments was offered.

Local, State, and National Conferences. The IACP project has been a major focus at many local, state, and national conventions and conferences in industrial education--including industrial arts, and technical and vocational education--as well as at conferences of curriculum specialists and administrators. Educators recognize that to remain in a leadership position, they must stay abreast of innovative curriculum developments, especially those that have the potential for revolutionizing the structure, content, and teaching methods in their own discipline.

Business and Industry. Throughout the development of the IACP program, the conviction was held by members of business and industry that the curriculum materials produced would have broad national potential for improving the secondary school industrial arts program. This was borne out when seven major publishers expressed an interest in competing for the rights to publish the IACP software materials. The involvement of representatives of business, industry, and labor on a national advisory committee to guide the development of the Industrial Arts Curriculum Project, the writing of text readings by representatives of industry, and the active support and participation of industry in IACP dissemination efforts have added immeasurably to the image and stature of the IACP program.

Impact of IACP on Curriculum and Instruction

The IACP curriculum package was conceived, developed, field tested, and revised over a four-year period, and it now appears to be experiencing wide acceptance by the profession. This acceptance is being multiplied by the successful dissemination efforts of a commercial publisher. The complete IACP package will serve as a criterion for future curriculum development projects. The curriculum package is compatible with conventional industrial arts programs and facilities.

Curriculum and instruction in industrial arts programs across the United States and in several foreign countries are changing dramatically as a result of the influence of the IACP on the profession. Adoption or adaptation of the IACP instructional systems by school personnel has resulted in a program which is better able to meet the educational needs of youth in our fast changing society. The resulting emphasis upon relevance, accountability, educational-occupational guidance, and integration with the culture and the world of work has been and will continue to be substantial.

Comparison of Conventional Industrial Arts to IACP. The IACP has developed a program which can well be classified as a leader which has set the pace for change in at least one discipline on the educational scene. Within the school systems in which the IACP program was field tested, definite changes have occurred in curriculum and instruction. The following are some of the more significant comparisons and contrasts between conventional industrial arts and the IACP innovative curriculum. Both programs are based on the assumption that industrial arts is the study of industry.

	Conventional Junior High Industrial Arts Curriculum		IACP Innovative Curriculum
1.	Typically woods, metals, and drafting. Study of materials, tools, processes used to fabricate custom projects	1.	Construction and manufacturing. Study of technologies of managed-personnel-production systems used to produce our man-made world
2.	One semester to one year. Teacher and district outlined courses	2.	Two one-year, uniformly structured, integrated courses
3.	Project-centered	3.	Concept-centered with industry-related activity
4.	Little provision for accountability for teacher and student	4.	Provides high level of accountability for teacher and student
5.	Behavioral objectives normally not stated	5.	Specifically stated daily behavioral objectives
6.	Only general objectives provide guidance	6.	General and specific daily behavioral objectives provide guidance and lineage of achievement
7.	Instruction dominated by facilities, equipment, and materials	7.	Instruction largely independent of facilities, equipment, and materials
8.	Developed by individual teacher or small group of teachers	8.	Developed by over one-hundred educators and industrialists

9. Teacher is prime source of knowledge augmented by reference materials	9. Industrial experts are the prime source of knowledge augmented by teacher and instructional system
10. Limited and fragmented study of industrial knowledge	10. Systematic study of organized bodies of industrial knowledge
11. Course design provides for a study of selected parts but not the whole	11. Course design provides for analysis and synthesis
12. Classroom textbooks used as reference by class, adapted to course	12. Each student has own textbook, designed specifically for course
13. Books lack cognitive organizers of relationships of concepts	13. Books provide cognitive organizers of relationships of concepts
14. Laboratory references typically used to stimulate project ideas	14. Laboratory manuals used as extensions of textbook. Provides representative applications of concepts through processes and problems. Each student has his own laboratory manual
15. No detailed teacher's guide but some lesson plans	15. Teacher's guide suggests instructional objectives, procedures, supplies, and equipment
16. Few standardized achievement tests	16. Major national field testing which led to standardized achievement tests
17. Difficult to coordinate interdisciplinary experiences	17. Broader and more comprehensive relationship to other subject areas, e.g., mathematics, social studies and contemporary problems, English, science

18.	Largely of historical, social, and industrial relevancy	18.	High degree of contemporary social and industrial relevancy
19.	General lack of support by industrial representatives	19.	Has obtained support, interest, and cooperation from industry
20.	Relatively low degree of program continuity and articulation	20.	High degree of program continuity and articulation
21.	Teaching methods and techniques limited to few traditional standbys	21.	Wider variety of teaching methods and techniques, e.g., gaming, role-playing
22.	Relatively unplanned pattern of daily instruction	22.	Pre-planned pattern of daily instruction, e.g., objectives, overviews, presentations, demonstrations, discussions, activity management, assignments
23.	Audio-visual materials not specifically designed to teach concepts. Teacher must make his own	23.	Audio-visual materials specifically designed to teach concepts. Available as part of instructional system
24.	Teacher generates supply list, identifies supplier, determines cost, etc.	24.	Established supply list, suppliers' costs, etc.
25.	Exact quantities of materials and equipment not known	25.	Exact quantities of materials and equipment known
26.	Projects used do not reinforce contemporary industrial practices	26.	Relevant products used to support concepts and activities, e.g., principles of engineering and design studied by developing model rockets and land speed record assault vehicles

27.	Focus on in-depth manipulative skills and specific understanding	27.	Focus on broad cognitive, affective, and psychomotor skills and general understanding
28.	Activities and studies extend over long period of time (two to six weeks per project)	28.	Activities and studies relatively short (one to three days); fast changing learning experiences
29.	Limited exploration of materials and processes	29.	Broad exploration of many materials and processes
30.	Studies focus on processes, tools, materials, and projects--low degree of relationship to management, personnel, and production practices	30.	Studies focus on management technologies of planning, organizing, and controlling; personnel technologies of hiring, training, working, advancing, and retiring; and production technologies of preprocessing, processing, and postprocessing
31.	Students generally work alone as compared to group effort	31.	Students cooperatively function as a group to achieve goals, work individually as called for in objectives
32.	Discipline problems arise because of lack of student involvement in paced activities	32.	Decreased level of discipline problems because of high degree of structured student participation
33.	Reading skills not stressed through program	33.	Reading skills stressed throughout program
34.	Adaptable and flexible within confines of school facilities	34.	Adaptable and flexible within confines of school facilities
35.	Provides interest and purpose to school studies	35.	Provides increased interest, relevancy, and purpose to school studies

Student Behavior. How has the student changed as a result of his experiences in "The World of Construction" and "The World of Manufacturing"? The meaningfulness and relevancy of the IACP program have improved considerably the transfer of knowledge and skills from the instructional program to the out-of-school world in which the student lives. As a result of IACP course experiences, numerous behavioral changes have evolved in the lives of the students. Examples of these are as follows. The student has been able to:

1. Place construction and manufacturing technology in the broader context of industrial technology and all of technology.

2. Be aware of the history, present character, and future of the construction and manufacturing phases of industry.

3. Appreciate, understand, and perform selected management practices in planning, organizing, and controlling as they relate to construction and manufacturing production systems.

4. Appreciate, understand, and perform selected personnel practices of hiring, training, working, advancing, and retiring as they relate to a managed production system in construction and manufacturing.

5. Appreciate, understand, and perform selected production practices in preprocessing, processing, and postprocessing or servicing as they relate to industrial production systems.

6. Appreciate and understand the interrelationships within and between management, personnel, and production practices.

7. Appreciate and have some understanding of constructed projects and manufactured products and the tools and materials utilized in their construction or manufacture.

8. Utilize the knowledge and skills of construction and manufacturing management and production to investigate factors involved in the making, operating, and servicing of representative products.

9. Develop an awareness of vocations in construction and manufacturing industries.

10. Develop responsible and safe work attitudes and the ability to function as a member of a group.

11. Develop an awareness of self-realization and generate self-activating behaviors.

12. Develop an awareness of the social impact of industrial technology and the role of the individual in affecting it.

One thing seems certain--the merits of the new program far outweigh whatever disadvantages there might have been for all of the many schools that field tested the program. Not one chose to discontinue it and return to its former offerings because of shortcomings inherent to the IACP program. That record will stand as a testimony to the value of the innovative program and will be influential in its continued expansion and effect upon the learner.

Program Costs. Program costs of IACP should be compared, in a general way, with costs of conventional industrial arts courses. Inasmuch as so many factors must be considered when approaching the subject of installation and teaching costs of "The World of Construction" and "The World of Manufacturing," careful consideration must be given to each of the following:

1. Are new laboratory facilities needed?

2. Will existing laboratory facilities be used?

3. Will existing laboratory facilities be used as they exist or will they need to be remodeled?

4. What kind, size, and quantity of equipment, machines, and tools are to be found in existing facilities?

5. Is there existing audio-visual equipment and is it available for use?

6. Will new audio-visual equipment be needed? How much?

7. What quantity of books and laboratory manuals will have to be purchased, i.e., one set per class or one set per facility?

8. What quantity, if any, of jigs, fixtures, apparatus, teaching aids, and other hardware will be teacher-made?

9. What items and in what quantity will commercially made IACP materials be purchased?

10. What quantity of materials, if any, will be donated by industry?

These and other questions must be answered if an accurate estimate of program costs of "The World of Construction" and "The World of Manufacturing" is to be made. From the experience of the six Field Evaluation Centers, it can be said that the initial cost of equipping an IACP laboratory or shop is only a small fraction of the cost of equipping the facilities of conventional industrial arts courses. Once the IACP courses are in operation, i.e., after the first year start-up costs, the cost of operating an IACP "World of Construction" and "World of Manufacturing" course does not exceed the cost of operating conventional industrial arts woods and metals classes. For a detailed list of the cost of commercially prepared IACP materials, contact the McKnight & McKnight Publishing Company, Bloomington, Illinois.

Impact of IACP on Personnel

This section presents the impact that the IACP has had upon the project personnel, both headquarters and field staff; graduate students; school district personnel, including teachers and administrators; and the lay public consisting of parents, students, and people from business and industry.

Educational Personnel-Headquarters Staff. The IACP grew out of a request by the Cincinnati Public Schools for help from The Ohio State University in developing an industrial arts curriculum which would be in step with 20th-century industrial technology. A readiness to honor the request existed. Two meetings had already been held in 1962 and in 1964, between faculty members from the University of Illinois and OSU to discuss the precise problem and to investigate the possibilities for gaining support for developmental curriculum study in industrial arts.

The headquarters staff was gratified by the acceptance of the project by other teacher training personnel, secondary school administrators, students, teachers, parents, and people in business and industry. Close working relationships developed between members of business and industry as experts from construction and manufacturing were involved in writing and evaluating materials for the program, particularly for the textbook. The project staff was impressed by the willingness of industrial management and labor to provide expertise and to help share the financial burden of this curriculum undertaking.

Inputs of knowledge and expertise from many colleges and universities played an important part in the formulation of the rationale and structure of the discipline of industrial technology.

Public schools and other colleges and universities shared in the concern for curriculum development and cooperated in the development and field testing of the innovative curriculum in centers across the nation. The field centers and their personnel brought to light many problems that were initially unrecognized. Thus, the IACP staff enlarged their field of perception and range of expertise in dealing with school problems as theories were converted into practice.

The faculty of industrial technology education at The Ohio State University enlarged its range of professional contacts and shared its concern for improving the junior high school industrial arts program on a large scale, since they worked cooperatively with forty-five colleges and universities to establish workshops through which inservice teachers could be prepared to implement the IACP program. This concern for curriculum improvement, by many leaders in industrial arts, has strengthened the professional bonds among college and university industrial arts faculties.

Close working relationships were developed between the USOE, The Ohio State University Research Foundation, and the IACP headquarters personnel. The preparation of research proposals and the establishment of funding channels added to the experience of The Ohio State University faculty. Federal funding of the IACP at approximately two million dollars made the project one of the largest educational research ventures at OSU. Thus, the stature of the faculty, in achieving project goals, has increased in the eyes of many. The stature of the faculty at OSU has also increased in the eyes of those in the profession, as their combined leadership guided the largest curriculum undertaking in the history of industrial arts education.

Personnel associated with the IACP have gained recognition at all levels as they participated in programs at conventions, conferences, training workshops, and in many other capacities. Many journal articles have been generated by the project staff and others associated with the project. These have appeared in professional journals concerned with industrial arts and vocational education, administration and supervision, research, and general education. Articles have also appeared in trade publications in the field of construction and manufacturing. Numerous brochures, flyers, and in-house information papers have also been developed and disseminated. As a result of the experience with IACP, one staff member has written a book on curriculum development.

Field Staff. Field center directors and demonstration center supervisors, as well as all participating IACP teachers, shared in professional growth through this curriculum development and dissemination effort. For the first time in many schools, industrial arts teachers became recognized as equals with those teaching academic subjects because they now were participating in a well-structured program with national recognition. As a result of involvement with the IACP, many contacts were made within and without the profession. Many of the teachers and directors participated as speakers and discussion leaders at local, state, and national meetings. Some published articles as an outgrowth of their experience. Almost all Field Evaluation Center teachers and directors served as teachers and directors of official IACP workshops across the nation during the summers of 1970 and 1971. Many teachers served in leadership capacities by conducting inservice training sessions for other industrial arts teachers in their school systems. Close associations were formed with personnel from business and industry, as teachers and administrators invited them to observe the relevancy of course content to life's problems in an industrialized society.

Head teachers of construction and manufacturing, as well as Field Evaluation Center directors, gained valuable firsthand experience in curriculum development as they worked with the project during the summers and through field test experiences during the school year. They became familiar with the challenge of large-scale curriculum development and realized the importance of utilizing a systems approach in such endeavors.

Through involvement with the IACP, teachers and directors developed better relationships with their local administration, other faculty members, students, and the lay public. The attitude of most teachers was positively affected as teachers came to enjoy a feeling of greater accomplishment in working with children, knowing that they were contributing to their better understanding of the man-made world and how man produces and services products to meet his needs and wants.

Graduate Students. The influence of the project has been felt by graduate students at The Ohio State University and other colleges and universities. The project has made more opportunities available, provided financial aid, exposed students to innovative ideas, and provided a variety of research and development related experiences.

Through experiences in technical writing, editing, research, activity development, teaching, and development of teaching methodology, in addition to exposure to a broad-based graduate curriculum, graduates of The Ohio State University have been well prepared for leadership positions in the profession. Graduate students have been actively recruited by other institutions and all have been placed in responsible positions.

The project made support monies available to increase the number of graduate students at Ohio State University from the typical three to five per year to eight to twenty-four per year. Student aid grants of $4,500 for nine months and additional contracts for summer sessions made it possible for most graduate students to enroll on a full-time basis and complete their degree requirements within three years. During the life span of the IACP, over fifty graduate research associates were employed and 22 men received a doctorate in industrial arts education.

Graduate students have been exposed to new and innovative ideas. Since the project focused on curriculum development, studies were directed to the examination of the philosophical, social, epistemological, and human foundations of curriculum development. Many innovative curriculum ideas were compared and contrasted in order to identify and critically analyze their theories, practices, and resultant impact upon the profession. The IACP has done much to codify and develop a body of industrial knowledge. Research associates have been oriented to its philosophy and developmental system. Only history will record the extent of the impact that the program has had upon the graduate students and the impact that they in turn, will have upon others as they assume positions in the academic community.

Through the efforts of graduate students, the scope and wealth of knowledge at The Ohio State University and other universities, as well as the profession in general, has been increased. Approximately 60% of the dissertations produced during the project years related directly to, or were outgrowths of, project concerns. There are indications that studies relating to the project are also evolving at other institutions.

Administrators and Students. The program has had almost total support from educational administrators. As a personal experience, the director of the Field Evaluation Center at Long Beach, California reported that he had more interest and support shown for the Industrial Arts Curriculum Project courses by these people during the past three years than had been shown by these same groups during his previous seventeen years of experience as an industrial arts supervisor. Administrators realize that the background, rationale, structure, course content, and teaching methods of the IACP program have all worked together to produce a program which is relevant and which presents industrial arts content in step with 20th-century technology.

School systems have conducted evaluation studies which indicate positive effects upon students in the IACP program. In many cases, achievement in the areas of language and reading, mathematics, science, and social studies has increased. Student discipline problems have decreased in IACP classes. Students appear to find the IACP courses interesting and worthwhile, and other subjects as well as industrial arts often take on new meaning. In many cases, pupils have found their view of occupations expanded and brought into better focus as a result of their exposure to a broad range of occupations in the fields of construction and manufacturing. Perhaps of more enduring value is their increased awareness of the fundamental nature of industrial technology and of its impact on them and on society. Presumably such awareness will lead to intelligent use and control of technology as opposed to possible enslavement by it, due to ignorance.

Administrators have been pleased to learn that the cost of implementing this new, interesting, relevant, and innovative program remains about the same as for conventional programs in industrial arts. Many have been especially impressed with the fact that, in planning new facilities, they can have both the advantage of an upgraded program as well as a considerable savings in initial expenditures for program installation.

The fact that no school which was involved in field testing the program returned to a conventional industrial arts offering after the experimental cycle, because of dissatisfaction with the project, is an indication that the IACP program met favorably with teachers, administrators, and students.

Business and Industry. Because the IACP personnel realized the need for involving people from business and industry in order to develop an interesting, meaningful, and relevant program for junior high school industrial arts, a closer working relationship developed between education and industry at all levels. Knowledgeable people from industry and industry-related associations were thrust into the mainstream of curriculum development. Support by industry was made available at many levels and in many ways. The expertise of individuals was utilized in writing the majority of the textbook readings. Personnel served on advisory committees at local, regional, and national levels. Financial support was provided for the development of films, printing of curriculum materials and promotional materials, undergraduate scholarships, and sponsorship of summer training workshops for in-service teachers.

Community relations were improved as local business and industry groups joined in support for the program. Their representatives met with school superintendents, boards of education, teachers, and parents in efforts to support this new and meaningful program. Because of their interest in and committment to the project, they often provided "seed" money and supplies to help initiate the program. They often sponsored contests and field trips, and made their personnel available as resource people.

Throughout the development of the IACP program, the conviction was held by members of the IACP staff that the curriculum materials produced would have broad national potential for secondary school industrial arts programs. This was borne out when seven national publishers expressed an interest in competing for the rights to publish the IACP software materials. In competition with other publishers, the McKnight & McKnight Publishing Company was awarded a five-year limited copyright contract by The Ohio State University Research Foundation. Based on an awareness of the market potential and the need for a relevant, contemporary program in the field of the industrial arts, the company then proceeded to turn over a major part of its publishing know-how, effort, and facilities to the preparation and publication of the commercial editions of The World of Construction and The World of Manufacturing. The IACP impacted upon the publishing industry in a unique way. Materials which had been developed by hundreds of educators and by business and industry personnel and which had been extensively field tested, would now become available through a commercial publisher who would return royalties to the J.S. treasury. This approach to curriculum development and dissemination is unique to the Industrial Arts Curriculum Project.

Parents. The general public responded favorably to the need for contemporary industrial arts offerings in the junior high school. Their concern and support were evidenced in several ways. Letters were written to governmental agencies requesting additional funding to see the project through its full six-year development and dissemination cycle; parents requested boards of education to expand the IACP program to all schools in the district, responded to program evaluation questionnaires, reviewed instructional materials, enthusiastically supported IACP open-house programs, and visited the IACP classrooms and laboratories during regular school hours.

Typical parent responses suggest that IACP courses are without equal and, through the conceptual approach, offer their children an opportunity to synthesize the "big ideas" related to "efficient doing" in industry. Most parents have indicated that the accomplishments of their children in the IACP program are superb. But they raise the question: Why did it take so long to develop courses such as "The World of Construction" and "The World of Manufacturing"?

Recommendations

The experience of developing the IACP program has been a fruitful one. With the expenditure of approximately two million dollars from the USOE and additional contributions of energy and efforts of local school systems and industrial firms and associations, expertise has been developed in creating and perfecting a system for researching, developing, evaluating, and implementing a two-year educational curriculum on a national basis. The program which has evolved is relevant and appropriate for our technological society and has been well received by the profession and the public. The IACP has been successful in providing a structured instructional program for the junior high school grades. Educators generally agree, however, that it is extremely important to provide continuity in a discipline from grades K-12, and that the need for relevant industrial arts instructional programs at all grade levels is imperative in order to provide industrial literacy for our citizens. This goal is especially important today because of the increasing advances of technology and its impact upon people. Moreover, college-level teacher training programs must be restructured to provide teachers with adequate background for teaching in upgraded public school programs.

The existence of the IACP program has caused educators to examine the content of industrial arts at all levels. Many are convinced that industrial arts programs are in critical need of revision to bring them into focus with 20th-century industrial technology. The time for change is now, but little can be accomplished by continued small-scale, sporadic, and isolated efforts by individuals throughout the nation. Meaningful change can best be accomplished through large-scale curriculum development programs coordinated to provide program continuity.

Because the expertise now exists, and because the need is so critical, the following recommendations are made.

1. That the federal government with other appropriate agencies provide the necessary financial support to underwrite the cost of managing comprehensive industrial arts curriculum development programs for the following levels:

   a) kindergarten through sixth grade.
   b) senior high school, grades nine through twelve.
   c) post-high school adult education.
   d) undergraduate preservice teacher education.
   e) undergraduate liberal education.

2. That the federal government with other appropriate agencies provide financial resources for completing the following aspects of the original plan for the IACP program which were eliminated because of insufficient funding:

   a) development of supplementary sound-color films, filmstrips, concept films, and other audio-visual materials.
   b) development of supplemental instructional materials for students in accelerated classes and for students in below-average classes.
   c) development of alternate activity packages for the laboratory (doing) portion of the program.
   d) development of individualized learning packages compatible with computer assisted instruction (CAI) and other self-teaching devices.
   e) development of presentation materials to be used for disseminating the IACP program.

3. That the cooperative arrangements and efforts of education, business, and industry established by the IACP staff be continued and expanded in future curriculum developments.

4. That the professional expertise of the IACP staff and Field Evaluation Centers be utilized to continue the development, evaluation, and dissemination of industry-related curricula to help promote change in our public schools which will produce greater industrial literacy in our population.

5. That the instructional programs developed by IACP be recognized as viable programs for youth of secondary school age and be promoted as essential liberal education as well as career education.

BIBLIOGRAPHY

Bloom, Benjamin S., (Ed.) et al. Taxonomy of Educational Objectives. The Classification of Educational Goals Handbook I: Cognitive Domain. New York: David McKay Company, Inc., 1956.

Bloom, Benjamin S., J. Thomas Hastings, and George F. Madans, et al. Handbook in Formative and Summative Evaluation of Student Learning. New York: McGraw-Hill Book Company, 1971.

Buffer, James J. "Industrial Arts as Therapeutic Education for the Mentally Retarded." Where the Action Is. An Address at the 31st Annual Convention of the American Industrial Arts Association in Las Vegas, Nevada, Washington, D.C. The American Industrial Arts Association, 1969.

D'Ambrosio, Vincent C. "Comparative Psychomotor Achievement in Two Industrial Arts Courses." Unpublished Ph.D. dissertation, The Ohio State University, 1966.

Dugger, William E. "A Study of the Comparison of the Achievement of Industrial Arts Curriculum Project Students with Traditional Industrial Arts Students." Unpublished Ph.D. dissertation, The Ohio State University, 1970.

Fazzini, Phillip A. "A Comparative Study to Determine the Efficacy of Two Industrial Arts Program Approaches Upon Pupils' Attitudes Toward Manufacturing Industry." An Unpublished Ph.D. dissertation, The Ohio State University, 1970.

Hammond, Robert. "Evaluation at the Local Level." Tucson, Arizona: Project EPIC, 1968 (mimeographed).

Hollingshead, August B. Two Factor Index of Social Position, New Haven, Connecticut: Author, 1957.

Industrial Arts Curriculum Project. The World of Construction. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1970.

Industrial Arts Curriculum Project. The World of Manufacturing. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1971.

Krathwohl, D.R., B.S. Bloom, and B. Masia. Taxonomy of Educational Objectives, Handbook II: Affective Domain. New York: David McKay Company, 1964.

Kuwik, Paul David. "A Quasi-Experimental Study of Two Selected Units of the Industrial Arts Curriculum Project Materials to Determine the Measurable Additive Effects of a Unit on Design in Manufacturing Technology Upon a Similar Unit on Design in Construction Technology." Unpublished Ph.D. dissertation, The Ohio State University, 1970.

Mager, Robert F. Preparing Instructional Objectives. Palo Alto, California: Fearon Publishers, 1962.

Miller, Larry R. "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." An Unpublished Ph.D. dissertation, The Ohio State University, 1971.

Peter, Richard F. "The Development of a Comprehensive Achievement Test for The World of Construction." An unpublished Ph.D. dissertation, The Ohio State University, 1970.

Scriven, Michael. "The Methodology of Evaluation." AERA Monograph Series on Curriculum Evaluation. Edited by Robert E. Stake. Number 1. Chicago: Rand McNally, 1967, pp. 39-84.

Simpson, Elizabeth J. The Classification of Educational Objectives; Psychomotor Domain. Washington, D.C.: Welfare, United States Department of Health, Education, and Welfare, Office of Education-Vocational and Technical Education. Grant Contract Number OE5-85-104, 1966.

Stufflebeam, Daniel L., Walter J. Foley, William J. Gephart, Egon G. Guba, Robert L. Hammond, Howard O. Merrimar, and Malcolm M. Provus. Education Evaluation and Decision Making. Itasca, Illinois: F.E. Peacock Publishers, Inc., 1971.

Towers, Edward R., Donald G. Lux, and Willis E. Ray. A Rationale and Structure for Industrial Arts Subject Matter. ED 013955: ERIC Document Reproduction Service, The National Cash Register Company, 4936 Fairmont Avenue, Bethesda, Maryland 20014.

Walgren, Floyd Bronson. "A Comparison of the Written Achievement of Pupils in Two Disparate Industrial Arts Sequences." Unpublished Ph.D. dissertation, The Ohio State University, 1971.

Wenig, Robert E. "The Development and Testing of an Innovative Total Program Evaluation Schema for Industrial Arts Education." Unpublished Ph.D. dissertation, The Ohio State University, 1970.

APPENDIX A

Examples of Marked Copy

Marked copy was beneficial in determining areas of concern and the need for revision. Displayed on the following pages are examples of marked copy.

Exhibit 1 - The World of Construction marked copy concerning 1st edition, Assignment 81 "Erecting Mass and Masonry Superstructures."

Exhibit 2 - The World of Manufacturing marked copy concerning 3rd edition, Teacher's Guide Assignment 101-102 "Compressing and Stretching," Textbook Reading "Conditioning Materials," Laboratory Manual Activities 81A and B "Planning Processes."

Exhibit 1

Leave out part on quarrying rock.

ERECTING MASS AND MASONRY SUPERSTRUCTURES

In the last lesson, you learned about superstructures and ways in which they could be built. Frame superstructures may or may not be enclosed with walls and a roof. These kinds of framed superstructures will be studied in later lessons. In this lesson you will study the other two kinds of superstructures: 1) those which use a mass of materials, and 2) those which use a limited mass of materials for walls combined with a framework for the floors and roofs. Such walls, built of masonry, are called bearing walls because they support the weight of the superstructure as well as close in a walled area.

confusing - please clarify the difference

which ones?

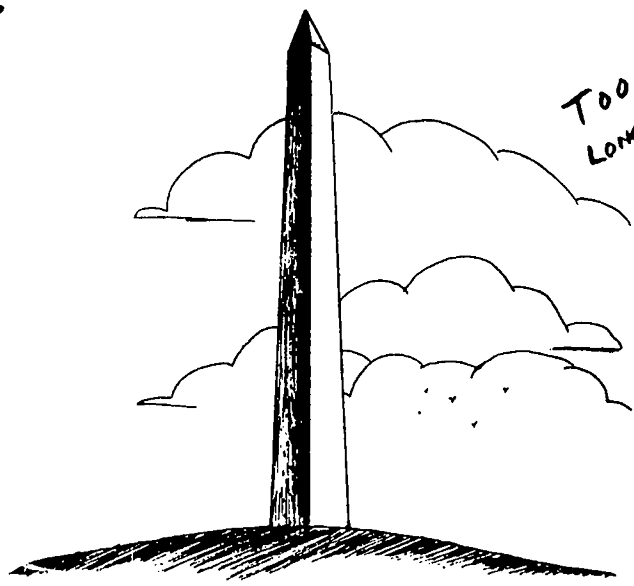
awkward ~~incomplete~~ sentence

MASS CONSTRUCTION

Soil may be used in a mass for a superstructure. It is used to build earth dams and other kinds of earth embankments. Soil is excavated or dug up at one place on the earth's surface and hauled to another location where it is dumped and spread to form the embankment.

Another material taken directly from the earth's surface is rock. Rock can be excavated in large blocks or pieces by quarrying which means cutting it or otherwise getting it out of the earth. These pieces can be used for massive or very large superstructures. The pyramids of Egypt were built of solid blocks of stone which were carefully quarried and shaped. These blocks were hauled to the site on rollers and were then moved up the side of the pyramid already built. This was done on wooden ramps using ropes and rollers. Many other monuments are built of blocks of stone. An example is the ?

confusing



TOO LONG

Washington National Monument
Washington, D.C.

Washington Monument in Washington, D.C. The blocks of stone for this were quarried and hauled to the site in trucks. Each piece was then lifted into place using a derrick resting on the part of the monument that had already been built.

Stone is quarried or cut out of the earth by drilling many holes spaced close together along the line of the stone mass that is to be the edge of the block. The block of stone can be broken loose from the mass by driving tapered steel pins into the holes, by filling the holes with wood plugs which are then soaked in water to make them swell, or by small charges of an explosive such as dynamite. Most rock masses are now quarried by using power driven saws which have blades of hardened steel. Grooves are sawed along the cutting line instead of drilling holes along it. Sometimes large pieces of quarried rock where the shape of the block is not important are needed. Breakwaters and jetties which ~~slow up the ero~~sion caused by ocean waves are superstructures made of irregular or odd shaped blocks of stone piled loosely in a long heap. These blocks of stone can be quarried by drilling and blasting.

Difficult for children to conceptualize

Mass superstructures also may be built of cemented aggregates. There are many kinds of aggregates and ways of cementing them used for mass superstructures. Concrete is the most common kind of cemented aggregate. In some new processes, soils are cemented with plastic materials; and, in primitive or early construction, aggregates have been held together by mixing them with straw, reeds, and brush.

You have learned something about concrete and how it is made and handled for foundation construction. You have learned how a concrete dam superstructure is built. There are other superstructures built by using concrete as a mass. Many retaining walls, some of which are used to protect the earth along rivers and ocean fronts from being washed away or to provide docks at which ships can unload, are built of concrete. Concrete mass superstructures are often used to support the framework of bridges.

not needed ?!

The surface of roads and highways is one kind of superstructure. Many of these are made of concrete. To build a concrete road, the earth along it is shaped to make a foundation. The fill dirt is compacted or pressed down until it is fairly hard. On this foundation, forms are set along both sides of the strip where concrete is to be placed. These forms are made of heavy steel sheets which are bent so that the top edges are rounded like the rails of a railroad track. They are secured or fastened to the foundation surface with long steel pins driven into the earth.

Trout

Today you have watched ~~the~~ your teacher show ~~you~~ how to lay concrete blocks. When you have completed today's activity, you should be able to lay 2 courses of concrete blocks or and place an anchor bolt in the foundation wall.

1. Obtain for your group the following tools and materials:

   Tools
   - 2 - masonry trowels
   - 1 - joint tool for tooling
   - ~~1 - garden trowel (hand)~~
   - 1 - 3' straightedge
   - 1 - 2' masonry level
   - 1 - chalk line
   - 1 - measuring tape
   - 1 - plastic measuring cup
   - 1 - plastic bucket (2 1/2 gal.)

   not enough time to tool blocks

   ~~Materials~~
   - 2 - cups of masonry cement
   - 2 - cups of portland cement
   - 10 - cups of sand
   - 5 - concrete blocks (8" x 8" x 16")
   - 2 - concrete blocks (8" x 8" x 8")
   - 2 - 3/8" dia. reinforcing rods 16" long
   - 1 - 1/2" dia. anchor bolt - 10" long
   - 1 - wire screen (fine mesh 6" x 6")
   - newspapers

   not enough mix

2. The ~~group should~~ divide up, so that two students can mix the mortar while the other students do the layout work on the footing.

MORTAR MIXING

3. Use the plastic measuring cup and place into the bucket the following ingredients:
   2 cups of masonry cement
   2 cups of portland cement
   10 cups of sand
4. Write the proportion ratio for this mortar. (1.1)______________________.
5. Use a garden trowel and mix the dry ingredients thoroughly. After this, add just enough water to the ~~mixture to make~~ a heavy paste similar to peanut butter. The mortar should be stiff enough to stand up by itself when shaped into a cone.

   crunchy or creamy?
6. Take the bucket over to your footing and leave the mortar in it until you are ready to lay the concrete blocks.

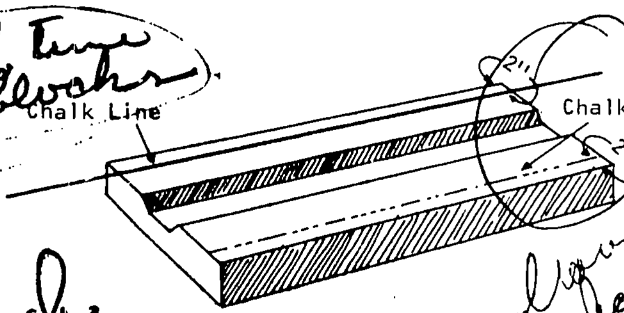
LAYING OUT WORK

7. Remove the plastic cover and spread newspaper around your footing.

   use plastic sheeting
8. By using a measuring tape and chalk line, mark off a line parallel - 2" from the edge on top of the footing. Do this for both sides as shown in the illustration.
9. What is the purpose of these lines? (1.2)

   ____

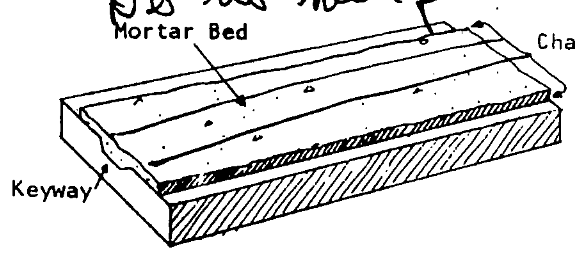
   ______________________________.



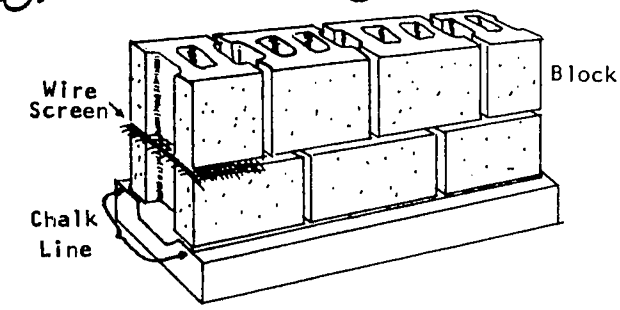
lay out chalk lines

10. Lay a full mortar bed between the chalk lines on the footing as shown in the illustration. Be sure to fill in the keyway with plenty of mortar.

Do not need full bed.



11. Follow the block laying procedure that your instructor has given you in his presentation. Lay 2 courses of block with 3/8" joints as shown in the illustration. Be sure to place the wire screen under one block hole on the end of the wall. ?



No. 81 ERECTING MASS AND MASONRY SUPERSTRUCTURES
THE WORLD OF CONSTRUCTION

Time In Class	Schedule
5	Laboratory Manual - Provides direction to complete the laboratory activity and questions to be answered.
5	Discussion - Summarize the day's learning experiences.

III. TEACHING PROCEDURES AND CONTENT

The following description is suggested to aid you in achieving the objectives for the day's learning experiences: Only about 1/2 did reading!

Time Out of Class	Schedule
15	Reading Assignment - Erecting Mass and Masonry Superstructures
15 TOO LONG	Workbook Assignment - Erecting Mass and Masonry Superstructures

Time In Class	Schedule
10	Presentation - Demonstrate the erecting of a masonry superstructure including mixing the mortar, laying out the work, laying the block, and setting anchor bolt. It will be necessary to have the mortar mixed before class begins. Only a few blocks may be laid in the given time limit.

Tools
1 - masonry trowel
1 - joint tool for tooling
1 - garden trowel (hand)
1 - 3' straightedge
1 - 2' masonry level
1 - chalk line
1 - measuring tape
1 - plastic measuring cup
1 - plastic bucket (2 1/2 gal.)

This mix should be doubled. There was not enough cement for the specimen

Materials
1 - cup of masonry cement
1 - cup of Portland cement
5 - cups of sand
3 - concrete blocks (8" x 8" x 16")
1 - concrete block (8" x 8" x 8")
1 - 3/8 dia. reinforcing rod
1 - 1/2 dia. anchor bolt - 10" long
1 - wire screen (fine mesh 6" x 6")
newspapers

Exhibit 2

DENNIS F. PARTEKEL
[illegible] Upper Grade Center
5625 South Mobile Avenue
Chicago, Illinois 60638
2-6-70 to
2-10-70

Assignment 101-102, Units 53B and C

COMPRESSING OR STRETCHING

OBJECTIVES

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

(Discussion)
1. Given a lecture on compressing or stretching material, describe:
   a. Ductile material.
   b. Malleable material.
   c. Plastic material.
2. Given a demonstration on compressing metal by forging, :
   a. Explain the basic difference between a squeezing force and a hammering force.
   b. Name a process used to form heads on nails and other similar fasteners.

(Laboratory Activity)
3. Given a demonstration on forging, and the necessary equipment and supplies, forge a screwdriver blade.

TIME SCHEDULE

Assignment 101 — LESS TIME NEEDED
- 5 Overview
- 15 Lecture-Demonstration
- 5 Discussion
- 20 Laboratory Activity — A BIT SHORT (REPORTED BY TWO TEACHERS)

Assignment 102 — GREAT!
- 45 Laboratory Activity

EQUIPMENT AND SUPPLIES FOR LECTURE

(Demonstration A, Cold Forging)

Equipment
- 1 overhead projector w/screen
- 1 ball peen hammer ?
- 1 vise
- 1 rivet jig — FIXTURE ?
- 1 2" C-clamp

Supplies — NOT NECESSARY
- 1 Transparency 101-1
- 2 pcs. 1/8" dia. x 5/8" soft aluminum wire ?

(Demonstration B, Hot Forging)

Equipment
- 1 anvil or equivalent
- 1 propane torch w/blowtorch head

Supplies
- 1 pc. 3/16" dia. x 6" drill rod

106
A little too long

READING 54

Conditioning Material

The last two readings have covered two of the three broad classes of material-forming practices. These were: (1) casting or molding, and (2) compressing or stretching. The purpose of these processes is to make a one-piece product or a component by changing the shape or dimensions of standard stock. These processes produce external (outside) changes which can be seen. GOOD USE OF SYNONYM

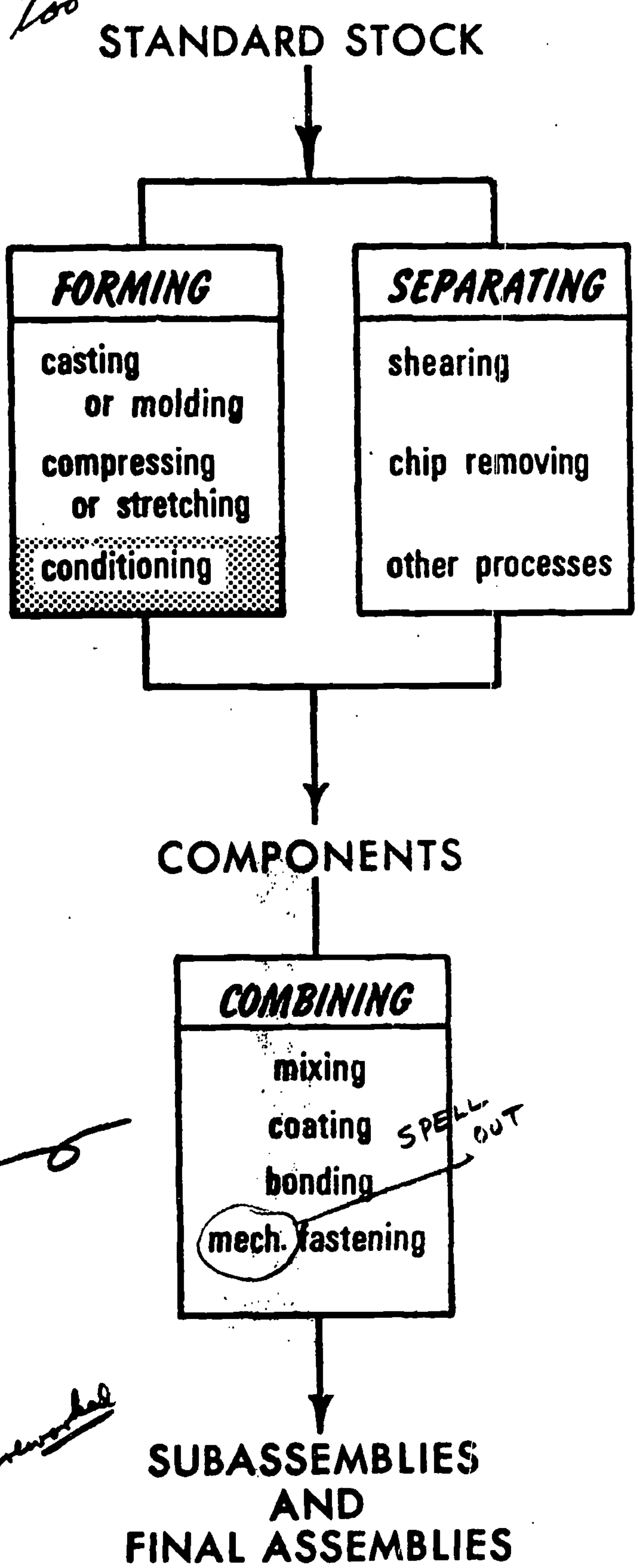
Conditioning is the third general type of material-forming process. Conditioning brings about changes in the internal (inside) structure of the material. Such internal changes usually do not produce effects that show externally; therefore, they usually cannot be seen. Conditioning is a step in the manufacture of many different products, from many materials. There are several conditioning processes that are very important in manufacturing products from metals, especially steel.

Reasons for Conditioning

The two main reasons for material conditioning are: (1) to make the material easier to work during processing, and (2) to give the final product a particular quality or desired characteristic.

Hardness is a material quality that often can be changed by conditioning. Hardness is important for metal components that must resist wear. Low hardness usually is preferred in materials that will be machines. machined. (?) needs reworded

Ductility and strength of material are other properties which can be increased by



The shaded area above, conditioning, is the subject of this reading.

Write hand methods on day 18A
& machine methods on day
DON'T write them both together. Too confusing for kids.

ACTIVITY 18 A and B

PLANNING PROCESSES

During the next 2 days you will try out some processes that might be used to manufacture salt and pepper shakers. You will compare hand and machine processes, to determine which is more efficient and accurate.

~~The class will be divided into 5 groups. For each problem 4 groups will use hand processes and 1 group will use machine processes.~~

PROBLEM 1 - GROUP 1

OBJECTIVE

Using 2 ~~techniques~~ methods for sawing to length, find out which is more efficient and accurate. process

Equipment (Group of 5)

Hand ~~Technique~~ method (A)

1	crosscut handsaw
1	bench vise
2	6" try squares
5	working drawings, from Activity 17

Machine ~~Technique~~ method (B)

1	miter box/saw
1	4" C clamp
5	working drawings, from Activity 17

Supplies (Group of 5) miter

1 pc 1 1/4" x 1 1/4" x 18" wood

A. Hand~~saw Technique~~ method

1. Measure 1/2" from one end of the workpiece. Use a try square and pencil to mark a line across the 4 surfaces of the piece of stock. See Fig. [redacted]-1.

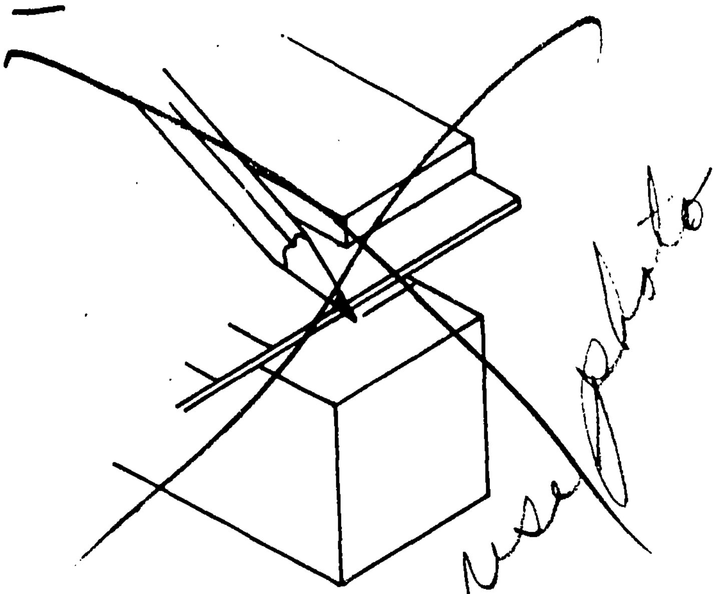


FIG. [redacted]-1 MARKING LINE

2. Place the wood in a bench vise. Saw off the 1/2" piece of wood, using a crosscut handsaw.

3. Refer to your plans for the height of the shaker. Measure this distance from the sawed end and mark a line across the 4 surfaces, using a try square and pencil.

4. Saw off the piece with a handsaw. See Fig. [redacted]-2.

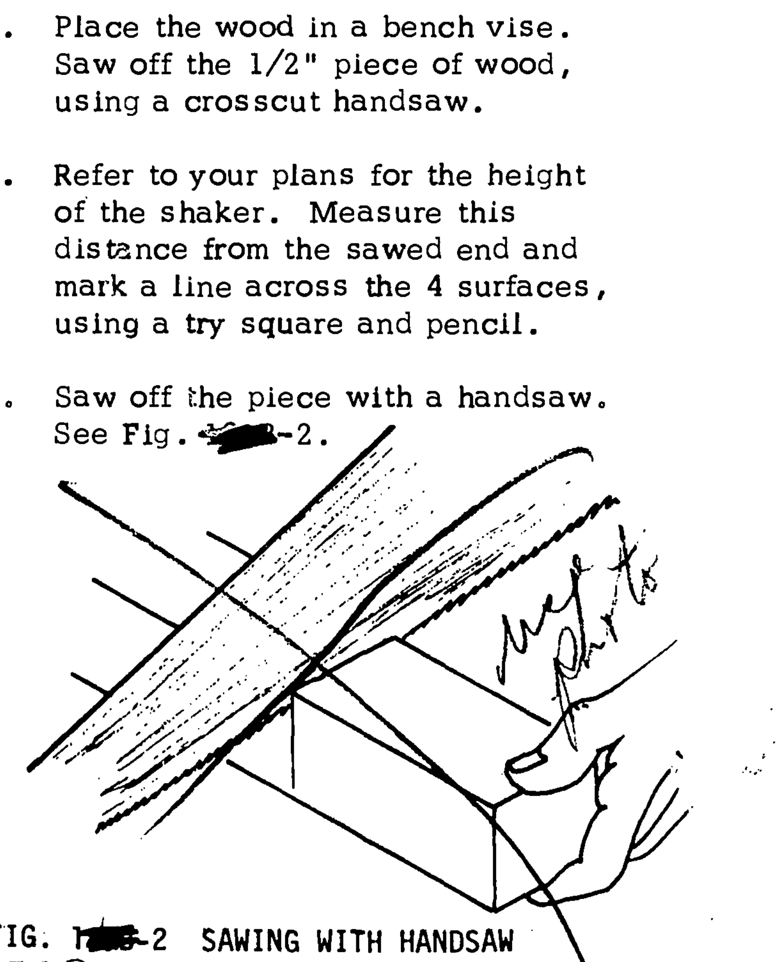


FIG. [redacted]-2 SAWING WITH HANDSAW

APPENDIX B

Copies of Daily Feedback Forms
and
Examples of Weekly Reports

Feedback forms evolved from a very complex set of forms that asked for detailed responses from teachers and students to a single form that covered all areas.

Exhibit 1 - Used by the Construction teachers on 1st edition

Exhibit 2 - Revised forms for 2nd edition Construction and 1st edition Manufacturing

Exhibit 3 - Revised form used for Construction 3rd edition and Manufacturing 2nd and 3rd edition

Exhibit 4 - Weekly Reports

Exhibit 1

Industrial Arts Curriculum Project
THE WORLD OF CONSTRUCTION

TEXTBOOK FEEDBACK FORM

Teacher________________________ Day No. ________ Date ________________

READING DIFFICULTY

1. Estimate the overall difficulty of the reading. Difficult 1 2 3 4 5 Easy

2. Were any of the sections too difficult for the students to read and understand? Yes________No__________ If yes, please make notations and comments directly in your review copy of the text.

3. Were there any technical terms which students did not understand? Yes_________No__________ If yes, please make notations and comments directly in your review copy of the text.

ILLUSTRATIONS

1. Estimate the degree to which the illustrations helped students understand the concepts presented. Low 1 2 3 4 5 High

2. Estimate how effectively the illustrations were correlated with the text body. Low 1 2 3 4 5 High

3. Do you have any suggestions for changing existing illustrations or adding new ones? Yes__________No___________ If yes, describe or sketch the illustration in your text or on the back side of this form.

REVISIONS TO TEXT BODY

If necessary, give specific suggestions for revisions to the text body which will help to improve student understanding of the concepts presented.

	Sub-Title	Revision
A.		
B.		
C.		
D.		
E.		

GENERAL COMMENTS AND NEW IDEAS (if any)

Industrial Arts Curriculum Project
THE WORLD OF CONSTRUCTION

WORKBOOK FEEDBACK FORM

Teacher ____________________ Day No. ________ Date __________

1. Estimate the difficulty of the questions and/or problems in the Workbook.

Difficult — Easy
1 2 3 4 5

2. Are there questions and/or problems which seem to be particularly difficult? Yes_______ No_______. If yes, list them below with the probable cause of difficulty.

	Question	Probable Cause
A.	____________	______________________________
B.	____________	______________________________
C.	____________	______________________________
D.	____________	______________________________
E.	____________	______________________________

3. Do you have specific recommendations for revision of the Workbook? Yes_______ No_______. If yes, list them below.

A. ____

B. ____

C. ____

D. ____

E. ____

4. General comments (if any).

Industrial Arts Curriculum Project
THE WORLD OF CONSTRUCTION

LABORATORY MANUAL FEEDBACK FORM

Teacher ________________ Day No. ________ Date ________

STUDENT ACTIVITY

1. Estimate the proportion of the students who completed the activity.

% 0 ———— 50 ———— 100 %

2. Estimate the level of student interest in the activity.

Low ———— High
1 2 3 4 5

3. Was the laboratory space adequate for conducting the activity? Yes______ No______

4. If the space was inadequate, identify specific problems.

A. ____

B. ____

C. ____

5. Were the recommended tools, equipment, and materials adequate for conducting the activity? Yes________ No____________

6. If the tools, equipment, or materials were inadequate, identify specific problems.

A. ____

B. ____

C. ____

7. Was the recommended procedure for conducting the activity satisfactory? Yes ________ No ____________

8. If the procedure was not satisfactory, identify specific problems and suggest revisions or alternates.

	PROBLEM	REVISION
A.	____________	________________________
B.	____________	________________________
C.	____________	________________________

Industrial Arts Curriculum Project
THE WORLD OF CONSTRUCTION

LABORATORY MANUAL FEEDBACK FORM

QUESTIONS

1. Estimate the percentage of students who completed the questions in class.

% 0 50 100 %

2. Estimate the difficulty of the questions

Difficult Easy

1 2 3 4 5

3. If some questions were particularly difficult or not appropriate, list them below and suggest revisions.

	QUESTIONS	REVISIONS
A.		
B.		
C.		
D.		
E.		

GENERAL COMMENTS AND NEW IDEAS (if any)

Industrial Arts Curriculum Project
THE WORLD OF CONSTRUCTION

TEACHER'S GUIDE FEEDBACK FORM

Teacher ____________________ Day No. ________ Date __________

OBJECTIVES

1. Estimate the adequacy of the objectives.

Inad. 1 2 3 4 5 Ad.

2. If necessary, make specific suggestions for revisions or additions to the objectives.

OBJECTIVE NO.	REVISION
A. ______	______
B. ______	______
C. ______	______

TEACHING PROCEDURES

1. The time allotted for the presentation was?

Too Long   Too Short   Correct

2. The actual time needed to present the lesson is ________ minutes.

3. The time allotted for the discussion was?

Too Long   Too Short   Correct

4. The actual time needed for discussion is __________ minutes.

5. Estimate the adequacy of the recommended teaching procedures.

Inad. 1 2 3 4 5 Ad.

6. If necessary, make specific recommendations for revisions to the procedures or suggest alternates.

PROCEDURE	REVISION
A. ______	______
B. ______	______
C. ______	______

TEACHING AIDS

1. Estimate the adequacy of the discussion questions or points.

Inad. 1 2 3 4 5 Ad.

Industrial Arts Curriculum Project
THE WORLD OF CONSTRUCTION

TEACHER'S GUIDE FEEDBACK FORM

2. If necessary, make specific suggestions for revisions or additions to existing questions or points.

QUESTION	REVISION
A. ________	________
B. ________	________
C. ________	________

3. Estimate the adequacy of the audio-visual aids.
(______ not included in this lesson)

Inad. — 1 — 2 — 3 — 4 — 5 — Ad.

4. If necessary, make specific suggestions for revisions or additions to existing audio-visual aids.

AID	REVISION
A. ________	________
B. ________	________
C. ________	________

PREPARATION TIME

Estimate the time required for preparing to teach this lesson. This estimate should include obtaining tools and materials, reading and study, practicing skill, rehearsing presentation, and scoring and checking.

Hours 0-1 1-2 2-3 3-4 4-5 5-6 6-7 7+

GENERAL COMMENTS (if any)

Industrial Arts Curriculum Project
THE WORLD OF CONSTRUCTION

STUDENT FEEDBACK FORM

DIRECTIONS:

Do not write your name on this sheet. This information will be used only as an aid to revise your Textbook and Workbook for other students. Please be frank and honest. Your class grade will NOT be affected in any way by your comments on this form.

1. Did you complete the reading of your Textbook assignment? Yes__________No________

2. Did you complete the questions and/or problems in your Workbook assignment?
Yes__________No__________

3. Estimate the difficulty of the following:

(a) Textbook Reading (check one)	(b) Workbook Questions and Problems (check one)
__________very difficult	__________very difficult
__________difficult	__________difficult
__________average	__________average
__________easy	__________easy
__________very easy	__________very easy

4. Comments (if any)

Exhibit 2

Industrial Arts Curriculum Project
Program Evaluation

THE WORLD OF CONSTRUCTION

TEXTBOOK-WORKBOOK FEEDBACK FORM

Teacher ____________________ Center ______________ Reading No. _____ Date Read ____

TEXTBOOK

READING TEXT

Indicate your feeling about the difficulty and length of the reading assignment by checking the appropriate blocks.

	1	2	3	4	5
Difficulty	Hard		OK		Easy
Length	Long		OK		Short

Indicate any improvements which you believe should be made in the text by listing the page number, paragraph number and the first two words of the sentence and then checking the block which corresponds to the kind of revision you believe to be necessary.

Pg.	¶	Sentence	M	D	R	SC

List any words which students did not seem to understand.

________________ ________________
________________ ________________
________________ ________________
________________ ________________

ILLUSTRATIONS

Identify any pictures, illustrations or captions which seem inappropriate for the text or which students do not understand by listing the page number and checking the other identifying information and then indicate what improvement you believe to be necessary by checking the block which corresponds to the revision you believe to be necessary.

Page	Picture	Caption	T	C	B	M	D	R	SC

WORKBOOK

After reading and evaluating each question and problem, indicate what you believe should be done to the item, if anything, in the next revision by checking either the satisfactory block or one of the other blocks which corresponds to the kind of revision you believe to be necessary.

	Question										Problem			
Item No.	1	2	3	4	5	6	7	8	9	10	1	2	3	4
Satisfactory														
Modify														
Delete														
Replace														
See Comments														

GENERAL COMMENTS

Please state any ideas which you believe will aid in revising the items which you have checked above. Also, please state any ideas which you have for additions to the reading text, reading illustrations, workbook questions, and/or workbook problems.

Industrial Arts Curriculum Project
Program Evaluation

THE WORLD OF MANUFACTURING

LABORATORY MANUAL FEEDBACK FORM

Teacher ______________________ Center ______________ Activity No.___ Date Taught_____

INTRODUCTORY STATEMENT

Indicate your estimate of the adequacy of the introductory statement by checking the appropriate block.

1	2	3	4	5
Good		OK		Poor

GIVENS

Identify any given which in your opinion should be revised by listing the problem number and checking the identifying block or blocks and then check the block which corresponds to the revision you believe to be necessary.

Problem	Tool	Material	Situation	M	D	R	SC

List any specific tools, equipment or materials which you believe should be added to or deleted from the givens.

Add	Delete

TASK

Identify any task step which you believe should be revised by listing the problem number and task step and then check the block which corresponds to the kind of revision which you believe to be necessary.

Prob.	Step	M	D	R	SC	Prob.	Step	M	D	R	SC

ILLUSTRATIONS

Identify any pictures or illustrations which seem inappropriate for the task to be done or which students do not understand by listing the problem number and the step number which correlate with the illustration and then indicate what improvement you believe to be necessary by checking the block which corresponds to the revision you believe to be necessary.

Problem No.	Task Step	M	D	R	SC

QUESTIONS

After reading and evaluating each question, indicate what you believe should be done to each question, if anything, in the next revision by checking either the satisfactory block or one of the other blocks which corresponds to the kind of revision you believe to be necessary.

Question No.	1	2	3	4	5	6	7	8	9	10	11
Satisfactory											
Modify											
Delete											
Replace											
See Comments											

STUDENT INTEREST

Indicate your estimate of student interest in this activity by checking the appropriate block.

1	2	3	4	5
High		OK		Low

GENERAL COMMENTS

Please state any ideas which you believe will aid in revising the items which you have checked above. Also, please state any ideas which you have for additions to the introductory statement, the givens, the tasks, and/or the questions. Add another sheet of paper if you need more space.

Industrial Arts Curriculum Project
Program Evaluation

THE WORLD OF MANUFACTURING

TEACHER'S GUIDE FEEDBACK FORM

Teacher ______________ Center ______________ Day No. _____ Date Taught _____

OBJECTIVES

Indicate any improvements to the objectives which you believe to be necessary by listing the objective number and then checking the block which corresponds to the kind of revision you believe to be necessary.

Workbook					Discussion					Activity				
No.	M	D	R	SC	No.	M	D	R	SC	No.	M	D	R	SC

TIME SCHEDULE

After you have taught the lesson, indicate your findings about the time allottments by either checking the OK block or listing your estimate of accurate time allottments in the shorten or lengthen blocks.

	OK	Lengthen	Shorten
Out of Class			
Textbook			
Workbook			
In Class			
Review			
Discussion			
Presentation			
Activity			

PRESENTATION TOOLS AND MATERIALS

List any specific tools, equipment or materials which you believe should be added to or deleted from those listed under presentation.

Add	Delete

PREPARATION TIME

Indicate the amount of time you spent preparing to teach this lesson by checking the appropriate block. The amount of time should reflect all facets of preparation and grading.

Hours	0-1	1-2	2-3	3-4
Hours	4-5	5-6	6-7	7+

EACHING AIDS

Indicate any improvements to the teaching aids which you believe to be necessary by listing the teaching aid number and then checking the block which corresponds to the kind of revision you believe to be necessary.

Transparency					Film-Strip Film					Chart				
No.	M	D	R	SC	No.	M	D	R	SC	No.	M	D	R	SC

EACHING PROCEDURES

Indicate any improvements to the teaching procedures which you believe to be necessary by listing the procedure number and then checking the block which corresponds to the kind of revision you believe to be necessary.

Review					Presentation					Discussion					Activity				
No.	M	D	R	SC	No.	M	D	R	SC	No.	M	D	R	SC	No.	M	D	R	SC

ENERAL COMMENTS

Please state any ideas which you believe will aid in revising the items which you have checked above. Also, please state any ideas which you have for additions to the objectives, presentation tools and materials, teaching aids, and/or teaching procedures. Add another sheet of paper if you need additional space.

Exhibit 3

Industrial Arts Curriculum Project
Program Evaluation

Teacher____________________ Mfg.__________ Const.__________
Assignment No.________
Center____________________ Unit No.________

READING TEXT

Indicate your feeling about the difficulty and length of the reading assignments by checking the appropriate blocks.

	1	2	3	4	5
Level of Difficulty	Too Diff.		Appropriate		Very Appropriate
Length	Too Long		Appropriate		Very Appropriate

STUDENT INTEREST

Indicate your estimate of student interest in this activity by checking the appropriate block.

1	2	3	4	5
Very Low		Adequate		Very High

OBJECTIVES

Indicate your estimate of the level to which the objectives stated in the Teacher's Guide are fulfilled by the corresponding readings, discussions, and laboratory activities.

	1	2	3	4	5
LIST Objective Numbers	Not Acceptable		Good		Excellent

ACTIVITY TIME

This data refers to the time allotted in the Teacher's Guide for the completion of the laboratory activities.

Time allotted in Teacher's Guide	
Did you complete the activity as specified, in the allotted time?	Yes ____ No ____
Additional time needed	
Excess time	

PREPARATION TIME

Indicate the amount of time you spent preparing (gathering of materials and organizing) to teach this lesson by checking the appropriate block.

Hours 0-1/2	1/2-1	1-1 1/2	1 1/2-2
2-2 1/2	2 1/2-3	3-3 1/2	3 1/2-4+

MAKE ADDITIONAL COMMENTS ON REVERSE SIDE

Exhibit 4

WEEKLY REPORT

IACP
MANUFACTURING
DADE COUNTY, FLORIDA

DATE: September 25, 1969

PLACE: Miami Springs Junior High School

PERSONNEL PRESENT: Morris
Fales
Baszczoski
Baldwin

GENERAL BUSINESS:

Collection of feedback and forms.
Identification of necessary supplies.
Discussion of procedures for blocking out copyright.

I. UNITS

Unit 9 -	Problem:	More interesting products for survey. Teacher direction lacking or too complex.
	Solution:	Girls bicycles of kiddies bikes are too childish. Use motor cycles of mini bikes teacher need more exact info.
Unit 10 A -	Problem:	No space on charts. Information on catalog pages is lacking.
	Solution:	Provide complete info. in "catalog pages." modify charts in lab manual
Unit 10 B -	Problem:	Students need more teacher direction.
	Solution:	Teacher should be reader. Possibly condense activity.
Unit 10 C -	Problem:	Activity leaves excess time.
	Solution:	Reduce activity time or provide additional problem.
Unit 10 D -	DNU	
Unit 11 -	OK	
Unit 12 A -	Problem:	Students need more teacher direction.
	Solution:	Teacher should "lead students by hand" thru activity.

Respectfully submitted,

James F. Fales,
Head Manufacturing Teacher

LONG BEACH UNIFIED SCHOOL DISTRICT
BOARD OF EDUCATION BUILDING
701 LOCUST AVENUE
LONG BEACH 13, CALIFORNIA

January 14, 1970

INDUSTRIAL ARTS CURRICULUM PROJECT
Manufacturing

January 5, 1970 Meeting

Daily Lesson Discussion

Assignment 64, Unit 33A - Employment and Occupations in Manufacturing

Too many employment areas; this activity requires too much time to complete. Some small communities may not offer this variety of employment.

Assignment 65, Unit 33B - Employment and Occupations in Manufacturing

The concept of lower number, higher value is very difficult for most students. If the filmstrip is done slowly enough, many of the students can do fairly well.

Frames 23 and 26 were not included in the filmstrip (numbers assigned in Teacher's Guide).

Assignment 66, Unit 34 - Manufacturing, Personnel Technology

Group felt lecture should be shorter and activity longer; use more illustrations, up to 18 or even 24.

Assignment 67, Unit 35A - Hiring and Training

The lesson is a good one but the role playing type of activity very easily gets out of hand and students find it difficult to get back into the proper spirit of the lesson.

Assignment 68, Unit 35B - Hiring and Training (Optional)

Only Mr. Rodriquez did this lesson. His comments: "The laboratory activity for this lesson was very poor. It was difficult for students to identify the type of training method being depicted. Substitute something else for this."

Assignment 69, Unit 36A - Harnessing Energy from Nature

Students knew about this activity and looked forward to it. Success at all four schools.

William A. Guidinger, Chairman
Manufacturing Technology

WAG:ht
Encs.

Weekly Meeting
Trenton State College
10 Feb 70

Weekly Feedback
Trenton Center
Manufacturing 10 Feb 70
Ward Muller

UNITS 53B to 53F

General:

1. The kids are not getting the lab manual done during the activity. There is not enough time in the lab time period to get the manual work done let alone get the questions accomplished. It is ideal to have questions but they are not working out in a practical sense. No suggestions at the present time.

2. There was no provision for testing units 47-49 this year. Those units were totally left out. We suggest testing for concepts in 47-49 in test #5.

3. Note the newspaper articles enclosed. This center is having its share of upset and strike problems. In Hamilton Township today schools were closed due to a protest for more responsible education. See articles. Trenton State College is expected to shut down on Thursday due to administration problems festering since last summer. New Brunswick has two days off this week for what is understood as spring vacation. Trenton schools are in a salary dispute and on the verge of a strike. Needless to say when things around here straighten out we will be considerably happier than presently we are. Perhaps I speak for myself but my hunch is others share a desire to stabilize and get on with the job!

Unit 53C LM

1. Seems as if too much separating is going on without explanation that it is so. It violates the thinking we had of doing all the forming, THEN later doing the separating. It is ok but one should mention it in the LM and even TG as to WHY and simply that it is being done.

2. Propane torches are too expensive when a forge furnace is available. We must stick to the furnace only and let the propane torch be an alternate. We do not have five big anvils either in each laboratory. Suggest a cheaper alternate such as a small bench anvil or part of a railroad rail.

Unit 53D LM

There is definitely NO time for the kids to cut their own sheet metal. It MUST be done by the teacher before the kids get to class for this to work.

The teacher should ditto a copy of the templates for each student. He shouald be given this the day before the assignment in class so he can get it cut out. This saves valuable time in class the next day.

TG & LM 53D & E

1. Make some provision for squaring up the pattern when it is glued with the edges of the metal piece to which it is glued. Kids get it on at times cock eyed so that when they bend the hems and sides they are "out of wack."

see p. 2

Page 2. 10 Feb 70, Trenton, Mfg.

Unit 53E TG and IM

1. Mention handle will be made later in 57C & D. Confused kids and the teachers.
2. When do we solder the corner tabs????? Seems to be no provision ahead for it. Say in 53E when it will be to let the kids and teacher know in order to prepare for and anticipate it.

53F TG

1. Page 352 the paragraph under "lab activity" says both components are to be used later. We find only an activity for the badge later. Please put in when BOTH will be used later so one can anticipate it and look it up,etc.

Submitted,

Ward Muller

Assignment 16 Unit 10C Lab Manual Problem: Too much time
Suggestion: Need two more metals to test or reduce the time allowed for the activity by 5 min. Would suggest using only one aluminum, as the two look alike and the students do not know one from the other by just looking at them.

Assignment 15 Unit 10B No problems other than those noted on marked copy

Assignment 17 Unit 10D Optional Problem: Test Question
Suggestion: There should be no questions about optional days on the test, so change question 17 page 3 to material covered another day.

Assignment 18 Unit 11 Teachers Guide Problem: The lists and terms
Suggestion: All lists and terms which are to be identif in the Text Review Objectives need to be in the Teachers Guide. This a must for teachers who do not have acopy of the workbook, and if this is to be adopted by the mass of teachers they are going to want this included. They, the teachers do not have the time to make the lists that are required.

Lab Manual Problem: Not enough time
We suggest that more time be spent on this activity and the students will gain a better understanding of the concepts that we are attempting to teach. Suggest doing Problem I one day and doing Problem II on another day. If there are any students who do this exceptionally fast give them another card or two and let them write a sentence or a poem.

Assignment 19 Unit 12A Teachers Guide: Need the the questions and terms and difinitions, for the Text review in the Teachers Guide.
Lab Manual Problem: Chart and Testing the Flowchart
Suggestion: There must be more detailed information as to how this is to be done. In our center it was not clear to all individuals what was to be done and how it was accomplished.

Assignment 20 Unit 12B Teachers Guide: Problem Not enough instructions
Suggestions: Teachers who did not have the advantage of Covin's instructions at Ohio State experienced difficulty in understanding this assignment. There is a definite need for more detailed and simple information and instruction for this unit in the Teachers Guide. This is a must if this is to be successfully understood and accepted by the average teacher.

Assignment 21 No Problems

Assignment 22	Teat No 1	There was a question on the test wich pretained to material covered on an optional day. This question should be deleted and another question substituted.
Assignment 23	Unit 13	No Problems other than those noted on marked copy.
Assignment 24	Init 14A	Problem: Lab Manual Lab. Manual Illustrations Solution. Follow suggestions in marked copy Problem: Teachers Guide Instructions Suggestion: Rewrite the instructions to the theachers as the instructions presently are hazy and vague for this activity.
Assignment 25	Unit 14B	No Problems except those noted on Marked Copy
Assignment 26	Unit 15A	No Problems except those noted on Marked Copy

APPENDIX C

Description of Evaluation Conferences
January, 1968/August, 1971

I. 1968 Mid-Year Evaluation Conference, January 15-18. As an example, a brief report of the 1968 conference is presented in detail. Subsequent mid-year conferences were similar.

A. Participants were IACP field center directors, head teachers, IACP staff, and research associates.

B. General Comments. Initially, the participants discussed the problem of student enthusiasm during the first part of "The World of Construction." The reason for this lack of student interest seemed to stem from citing activities near the beginning of the course. A presentation of alternate course strategy to overcome this problem was made by the IACP staff with suggestions from the head teachers.

C. More specific agreements were reached as follows:

1. Two optional days needed at the beginning of the course would accommodate school and classroom administrative details.

2. The pretest would be administered in Assignment 3.

3. A simplification of Assignments 4 through 8, so that construction technology could be approached more directly

4. Introductory assignments were to be directed toward helping students to understand the relationships between advancing technology and efficiency in work. Students were to be introduced to basic tools that affect organization (management) or efficiency.

5. The following assignments should be combined: 14 & 15, 38 & 39, 49 & 50.

6. Expand the concepts dealing with placing concrete (Assignments 76-82), class organization (Assignment 47), and building wood frames (Assignments 88-93).

7. Modify and replace weak activities in Assignments 4 through 8, 11, and 12, 19 through 29, 38 and 39, and 82.

8. General course sequencing regarding the house model should remain where it is, in the later portion of the course.

D. Tests and Grading. A progress report of processing tests results from two previous tests that were given to each teacher with general normative information. The grading of students presented a problem to teachers. To help offset this, the following recommendations were made:

1. IACP should provide a punched scoring key with each test.

2. Each teacher should make every attempt to return tests immediately after administration so as to reduce lag time in processing.

3. Review time should be reduced or used as optional time.

4. Alternate test forms not yet available would allow scoring and reviewing of tests on the same day.

5. Limit periodic achievement tests to 25 items.

6. Participation, cooperation, quality of work, completion of work, etc., as well as scores on achievement tests should be considered as measures of evaluating student accomplishment.

7. Schedule tests during the semester so that they could be used as part of student evaluation.

8. Research efforts and guidelines are needed to develop techniques for measuring items listed in #6 above.

E. Feedback Procedure. The system handling teacher and student feedback was explained. A status report of this feedback system was made to field center directors and teachers. These people also received examples of processed feedback which resulted in the following recommendations.

1. Teacher feedback as an input for recommendations for changes to "The World of Construction" was to be included.

2. Changes in laboratory activities would be collected and mailed by head teachers.

3. The weekly meeting conducted by a head teacher or field center director should accomplish three things:

a) Identify major problems.
b) Identify or develop possible solutions.
c) Preview the forthcoming week to become familiar with new lessons and determine equipment and supply needs.

4. Discontinue student feedback until instruments and retrieval techniques are modified.

5. Progress of revisions and/or developments by IACP staff should be reported to those in the field.

F. Teacher Preparation. Discussion about teacher preparation during the 1967 summer preparation program attempted to identify those areas needing improvement. The suggestions included:

1. Increase the length of the session (more than two weeks).

2. Teachers should be involved in materials development.

3. Day-by-day explanation of the course should be provided to teachers.

4. Continue demonstration and simulation of lessons.

5. Expand experiences dealing with technical skill development.

6. Consider adding evening sessions to provide more preparation time.

7. Provide additional experiences involving role-playing techniques.

8. Teacher preparation could be begun earlier through correspondence study.

G. Administrative Detail. Field center administrative problems centered on small operating budget for field center directors, the placement of responsibility regarding handling of financial problems with school administrators, the acquiring of public relations publications, and obtaining building supplies from such organizations as local A.G.C. chapters.

II. 1968 Summer Revision Conference, July 1-August 8.

As an example of a summer revision conference, a resume of the 1968 conference is presented here. Subsequent conferences paralleled this program.

Participants in the conference were: IACP Field Evaluation Center directors and head teachers, headquarters staff, consultants, and research associates. Work assignments included:

A. Construction

1. A field center director and four head teachers worked on revising Assignments 93-185.

2. Two head teachers worked with demonstration school personnel. One head teacher conducted group studies in construction technology. One head teacher did photographic work for the IACP program.

B. Manufacturing

1. A field center director and four head teachers worked on revising Assignments 93-185.

2. Two head teachers worked with demonstration school personnel.

3. One head teacher conducted group studies in manufacturing technology.

4. One head teacher designed, developed, tested, and built course hardware and demonstration apparatus.

C. Two field center directors worked on course evaluation problems and procedures.

D. Eleven research associates were assigned to assist in the following areas: writing, feedback, construction supply, manufacturing supply, evaluation, and dissemination.

III. 1969 Conferences, January 22-25, July 1-8.

A. Participants were IACP field center directors, head teachers, headquarters staff, and research associates.

B. The conferences were objectively the same as they were in 1968—

to revise teaching procedures, the improvement of the activities used in the laboratory, the solving of supply problems, and the introduction of new activities. Extensive writing was done for each section of construction and manufacturing.

IV. 1970 Mid-Year Manufacturing Revision Conference, February 28-March 6.

A. Participants were Ohio State IACP staff, head manufacturing teacher and a second manufacturing teacher from each field center, research associates.

B. The purpose of the conference was:

1. To adjust the format of daily assignments.

2. To consider a rocket project as part of the introduction phase of the course. A trial firing was conducted.

3. To assign product developments to specific assignments.

4. To refine product development procedures within and between assigned days.

5. To insure continuity of the manufacturing course conceptual framework.

C. Accomplishments:

Adjustments were made in the placement or substitution of learning vehicles in the course design for semester one as follows:

Content	Intro. to Manufacturing	Researching, Designing, & Engineering the Product	Researching, Designing, & Engineering the Process	Researching, Designing, Engineering, Producing Product & Process (includes personnel)
Vehicle	1-1 (10) Clay product, coat hanger, rocket	11-30 (20) Land Speed Record Assault Vehicle	31-50 (20) Salt and Pepper Shakers	51-92 (42) Electric Buzzer

Text materials were revised to read as follows:

Reading No. Title of Readings

1. Man and Technology
2. The Evolution of Manufacturing
3. Manufacturing and the Economic System
4. Manufacturing Technology
5. Manufacturing Management Technology
6. Inputs to Manufacturing
7. Organization, Ownership, and Profit
8. Identifying Consumer Demands
9. Researching and Developing
10. Designing Manufactured Goods
11. Creating Alternate Design Solutions
12. Making Three-Dimensional Models
13. Refining the Design Solution
14. Obtaining Approval of Management
15. Engineering the Product
16. Designing Power Elements
17. Making Working Drawings
18. Building the Production Prototype
19. Technical Writing and Illustrating

Reading No. Title of Readings

20. Planning Production
21. Planning Processes
22. Automating Processes
23. Measuring Work
24. Estimating Cost
25. Tooling Up for Production
26. Installing Production Control Systems
27. Operating Quality Control Systems
28. Designing and Engineering the Plant
29. Establishing Accident Prevention Programs
30. Supplying Equipment and Materials
31. Processing Data or Information
32. Using the Computer
33. Employment and Occupations in Manufacturing
34. Manufacturing Personnel Technology
35. Hiring and Training
36. Working, Advancing, and Retiring
37. Organized Labor and Collective Bargaining
38. Securing Reproducible Raw Materials
39. Extracting Raw Materials
40. Harnessing Energy from Nature
41. Manufacturing Production Technology
42. Converting Raw Materials to Industrial Materials
43. Making Industrial Materials into Standard Stock
44. Story of Primary Metal Products
45. Story of Textile Mill Products
46. Story of Chemical Products
47. Story of Petroleum Products

Laboratory activities were revised as a result of the conference. The first list of activities (numbered 1 though 49) are as they appeared in the Second Edition. The second list (numbered 1 through 58) contains the revised Third Edition.

SECOND EDITION BEFORE REVISION

1. Man and Technology
2. The Beginnings of Manufacturing
3. The Industrial Revolution
4. Manufacturing and the Economic System
5. Manufacturing Technology
6. Manufacturing Management Technology
7. Inputs to Manufacturing

Reading No.	Title of Readings
8.	Organization, Ownership, and Profit
9.	Identifying Consumer Demand
10A	Researching and Developing
10B	Researching and Developing
10C	Researching and Developing
10D	Researching and Developing
11.	Processing Data or Information
12A	Using the Computer
12B	Using the Computer
13.	Designing Manufactured Goods
14A	Creating Alternate Design Solutions
14B	Creating Alternate Design Solutions
15A	Making Three-Dimensional Models
15B	Making Three-Dimensional Models
16.	Refining the Design Solution
17.	Obtaining Approval of Management
18.	Engineering the Product
19.	Designing Power Elements
20A	Making Working Drawings
20B	Making Working Drawings
20C	Making Working Drawings
20D	Making Working Drawings
21A	Building the Production Prototype
21B	Building the Production Prototype
22.	Technical Writing and Illustrating
23.	Planning Productions
24A	Planning Processes
24B	Planning Processes
24C	Planning Processes
25.	Automating Processes
26A	Measuring Work
26B	Measuring Work
26C	Measuring Work
27.	Estimating Cost
28A	Tooling Up for Production
28B	Tooling Up for Production
28C	Tooling Up for Production
29A	Installing Production Control Systems
29B	Installing Production Control Systems
30A	Operating Quality Control Systems
30B	Operating Quality Control Systems
30C	Operating Quality Control Systems
30D	Operating Quality Control Systems

Reading No.	Title of Readings
31.	Designing and Engineering the Plant
32.	Supplying Equipment and Materials
33A	Employment and Occupations in Manufacturing
33B	Employment and Occupations in Manufacturing
34.	Manufacturing Personnel Technology
35A	Hiring and Training
35B	Hiring and Training
36A	Harnessing Energy from Nature
36B	Harnessing Energy from Nature
37.	Securing Reproducible Raw Materials
38.	Extracting Raw Materials
39.	Manufacturing Production Technology
40A	Preparing Raw Materials
40B	Preparing Raw Materials
41A	Making Industrial Materials by Converting
41B	Making Industrial Materials by Converting
42A	Making Industrial Materials into Standard Stock
42B	Making Industrial Materials into Standard Stock
43.	Story of Primary Metal Products
44.	Story of Textile Mill Products
46.	Story of Petroleum Products
47.	Establishing Accident Prevention Programs
48A	Organized Labor and Collective Bargaining
48B	Organized Labor and Collective Bargaining
49A	Working, Advancing, and Retiring
49B	Working, Advancing, and Retiring

THIRD EDITION

1.	Man and Technology
2.	The Evolution of Manufacturing
3A	Manufacturing and the Economic System
3B	Manufacturing and the Economic System
4A	Manufacturing Technology
4B	Manufacturing Technology
4C	Manufacturing Management Technology
4D	Manufacturing Management Technology
5A	Researching and Developing
5B	Researching and Developing
6.	Designing Manufactured Goods
7A	Creating Alternate Design Solutions
7B	Creating Alternate Design Solutions
8A	Making Three-Dimensional Models

Reading No.	Title of Readings
8B	Making Three-Dimensional Models
9.	Refining the Design Solutions
10.	Engineering the Product
11.	Designing Power Elements
12A	Making Working Drawings
12B	Making Working Drawings
12C	Making Working Drawings
13A-C	Building the Production Prototype
13D	Building the Production Prototype
14.	Technical Writing and Illustrating
15.	Designing Manufactured Goods
16.	Obtaining Approval of Management
17.	Making Working Drawings
18A,B	Planning Production
18C	Planning Production
19.	Planning Processes
20.	Designing and Engineering the Plant
21.	Supplying Equipment and Materials
22.	Employment and Occupations in Manufacturing
23.	Automating Processes
24A	Tooling Up for Production
24B	Tooling Up for Production
25.	Installing Production Control Systems
26A	Processing Data or Information
26B	Processing Data or Information
27.	Using the Computer
28.	Manufacturing Management Technology
29.	Inputs to Manufacturing
30.	Organization, Ownership, and Profit
31.	Identifying Consumer Demands
32.	Creating Alternate Design Solutions
33.	Making Three-Dimensional Models
34.	Refining the Design Solution
35.	Engineering the Product
36.	Making Working Drawings
37A	Building the Production Prototype
37B	Building the Production Prototype
38.	Planning Production
39.	Tooling Up for Production
40.	Operating Quality Control Systems
41.	Measuring Work
42.	Estimating Cost
43.	Designing and Engineering the Plant

Reading No.	Title of Readings
44.	Hiring and Training
45.	Supplying Equipment and Materials
46.	Manufacturing Personnel Technology
47A-E	Manufacturing Production Technology
48.	Organized Labor and Collective Bargaining
49.	Working, Advancing, and Retiring
50.	Establishing Accident Prevention Programs
51.	Securing Reproducible Raw Materials
52.	Extracting Raw Materials
53.	Harnessing Energy from Nature
54.	Manufacturing Production Technology
55.	Converting Raw Materials into Industrial Materials
56.	Making Industrial Materials into Standard Stock
57A	Story of Primary Metals
57B	Story of Textile Mill Products
58.	Story of Petroleum Products

V. 1970 Summer Revision Conference, June 29-August 12 (Manufacturing only).

A. Participants were IACP field center directors, head teachers, headquarters' staff, and research associates.

B. General Comments

1. One IACP staff member served as curriculum development director.

2. One IACP staff member served as an evaluation director.

3. One Field Evaluation Center director served as a supervisor to review curriculum materials.

4. One teacher served as head manufacturing teacher for revising Assignments 93-141.

5. Three teachers worked on revising Assignments 93-141.

6. One teacher served as head manufacturing teacher for revising Assignments 142-185.

7. Three teachers worked on revising Assignments 142-185.

8. One research associate worked with Assignments 93-141 and another with 142-185.

9. Three Field Evaluation Center directors worked with text revision.

10. One teacher worked on redesigning illustrations.

11. Two Field Evaluation Center directors worked on filmstrip and slide development materials.

12. One IACP staff member (non-faculty) served as text editor.

13. Two research associates worked on hardware and shipping.

14. Three research associates worked on evaluation items.

VI. 1971 Mid-Year Evaluation Conference, January 14-16.

A. Participants were IACP field center directors; head teachers of construction and manufacturing; headquarters staff; Managing Editor, McKnight and McKnight Publishing Company; and research associates.

B. Purpose:

1. Evaluation of "The World of Manufacturing", semester one.

2. Examination and review of the new instructional materials for semester two of manufacturing.

3. Review of modifications recommended for manufacturing, semester one.

4. General evaluation of the instructional system for both courses.

5. Evaluation of and suggestions for modification of the 4th edition of "The World of Construction".

C. Agenda:

1. Status report concerning following areas: summer '71 teacher workshops, funding, third edition development, fourth editon preparation, McKnight & McKnight performance regard-

ing sales of instructional materials

2. General information questionnaire dealing with biographical data, professional characteristics, facilities, teacher preparation , budget requirements, public relations from teacher's viewpoint, and work load

3. Demonstration of school-developed projects as suggestions for inclusion or substitution in current construction or manufacturing junior high school programs

4. Refinement of product development procedures (e.g.,starting and finishing gate of LSRAV)

The mid-year and summer evaluations and revision conferences proved to be very essential parts of the total curriculum development and evaluation program. The utilization of teachers for the evaluation and revision of the program materials was invaluable in keeping the program interesting, meaningful and relevant for junior high school age youth.

VII. Summer Evaluation Conference, June 28-August 6, 1971.

Purposes:

1. Analyze and synthesize evaluation data for the final evaluation report.

2. Identify future research topics and strategy for the continual evaluation of the IACP instructional program.

Participants:

Four Field Evaluation Center directors worked with headquarters staff to accomplish the above goals. They were: Mr. Jack Ford, Dr. J. Russell Kruppa, Dr. Henry Sredl, and Dr. Glenn Warrick.

APPENDIX D

Evolution of Textbook Materials

Exhibit 1 - 1st Edition "The Earth Below" Reading No. 16

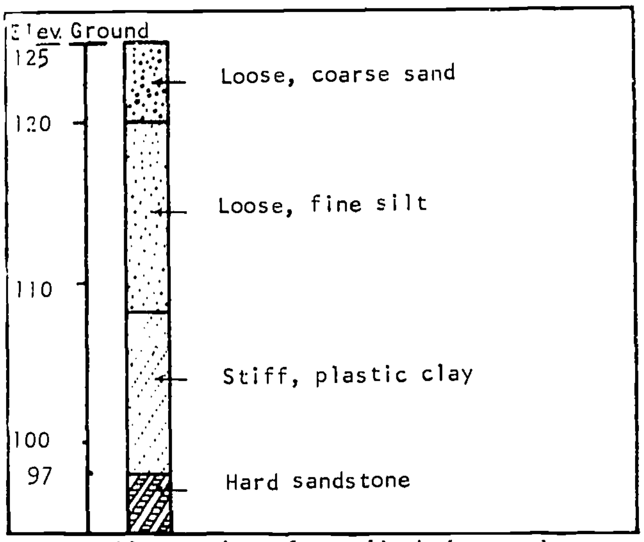
Exhibit 2 - 3rd Edition "Soil Testing" Reading No. 9

Exhibit 3 - 4th Edition (Commercial Copy) "Soil Testing" Reading No. 9

Exhibit 1

THE EARTH BELOW

The last lesson described land surfaces. This lesson will help you understand the characteristics of the soils which form the upper layer of the earth. Soil is used sometimes in the construction of a structure such as an earth dam but generally soil provides the load bearing surface upon which the foundation of a structure rests. No matter what the structure may be it must have a strong and stable foundation. Therefore, the characteristics of soil upon which the foundation will be built must be known so that the correct engineering decision can be made by the construction designer.



An illustration of a calix hole sample.

WHO DOES SOIL ANALYSIS

Major responsibility for soil analysis or testing (retrieving) lies with whoever is designing the project for the owner. This may be his own staff or the construction consultant. On large projects or when there are unusual soil, drainage, or ground water problems, specialists in soils may be hired. Drilling subcontractors are often hired to take borings and dig test pits. Sometimes laboratories are hired to test soils.

SOIL ANALYSIS

There are many ways to retrieve information about what kind of soil or rock is under the surface of the ground. Many times this information can be gotten from government agencies, properties next to the one in question, drillers, or private laboratories. In addition, the kinds of soils or rocks on the surface can be described just by looking at the site.

Soil is tested to see if it will absorb water. This is very important in sewage disposal plant design. Probing is done. This means rods are driven into the ground to test the hardness and to find where rock is. Holes are bored with different kinds of augers to find the depths of soils of different types. Sometimes water jets are used.

Test pits or calix holes, which are wide holes, let test people see what the soil is like. Core borings are made to pull samples of soil from the earth at different depths. These soils may be sent to a laboratory for tests.

Soil tests in the field are of two different kinds. First, there are plate bearing tests. In these tests about 4 square feet of earth is used. The stability and settlement is checked. Second, there are density tests. Soil is put in a standard cylinder and is hit with a certain number of blows with a hammer. This shows how much the soil packs together.

Laboratory testing (experimenting) is done to find out about strength, water in the soil, plasticity, compressibility or packing, and other soil characteristics when this information cannot be retrieved from other sources. Geophysical tests using explosives or the electrical resistance of the ground are often used. They are very helpful in finding how deep down rock is.

KINDS OF SOILS

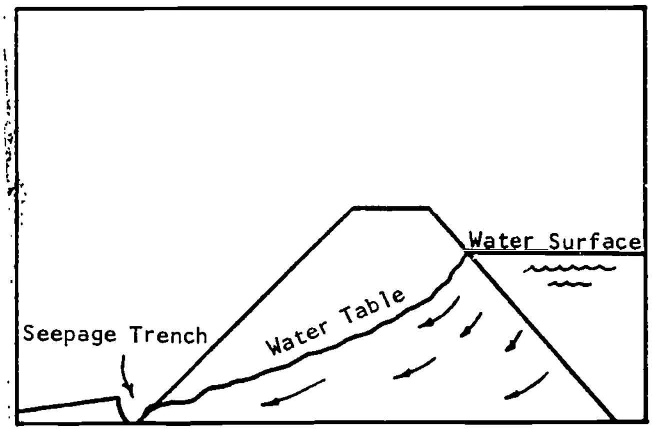
There are many kinds of soils. Rock is a hard material which requires great force to excavate or remove. There are several kinds of rock. Bedrock covers rather large areas. Actually, bedrock is under all of the earth's surface. However, in some cases, it is very deep below ground level. Boulders are large, loose pieces of rock. They are from about eight inches on up in size. Cobbles are smaller pieces of rock. They are about four inches to eight inches across.

Soils are loose parts of the earth's surface. They are made up of grains of different sizes. Gravel is a kind of soil which is in pieces from the size of a softball. Sand is made up of much smaller pieces. They are from the size of granulated sugar to the size of a pea. Silt is made up of pieces from the size of powder to granulated sugar. Clay is in very fine, small pieces--about the size of those in flour.

Most soils are made up of pieces of all different sizes--sometimes from the finest clays to large boulders. Therefore, all kinds of soils mentioned above are sometimes hard to classify. For example, a so-called silt may be made up of 75 per cent silt, 15 per cent clay, and 10 per cent sand.

GROUND WATER

Kinds of soils and what they can be used for depend a great deal on the amount of water in them. At least a small amount of water is in the spaces between grains of nearly all soils. Ground water is a more or less continuous body of water under the surface of the ground. It flows through the spaces between the soil grains. The top of this underground water, which can be found by digging an open pit, is called the "water table." The water level is not flat like the surface of a lake. Instead, it is a very, very slowly moving stream.



A diagram of a "water table".

SOIL CHARACTERISTICS

Soils are described by their characteristics. Soil particles or pieces are not smooth like marbles. They are different in size and shape. Sometimes they are rounded. More often they are jagged with sharp corners. They do not fill the whole space they are in. Because of the way they are shaped, there are spaces between the particles. These spaces are called voids.

Many soils, especially clays, are quite cohesive. This means that the grains stick together. In fact, some soils stick together so strongly that they are nearly like cement. These are almost as hard to work with as solid rock.

When the grains have large spaces or voids between them, the soils are called loose. When the voids are small, they are called dense. Density can be made greater by putting pressure or weight on soil. Many soils are compressible. This means that they can be packed down or compressed. Clays are often plastic. They can be molded into different shapes very much like modeling clay.

When most soils are excavated or dug up, they expand or swell. One hundred cubic yards of a certain soil in its natural state, if taken out and loaded onto trucks, might become 114 cubic yards. Then it is placed in a foundation for a building where it might be placed under pressure to reduce the voids between the grains. After this is done it may make only 85 cubic yards.

In general, many soils, especially those with a lot of clay in them swell as moisture is increased and shrink when it is taken away. Some clays "slake" or disintegrate into a soft mass when suddenly wet. A firm clay may lose its strength when water is in it.

When water freezes to become ice, it expands or takes up more space. If the water in the soil freezes, the soil also expands or heaves. This raises the surface of the ground. Then when the ground thaws, water forms and the soils become very liquid. The depth of frost in the ground depends on the weather. In general, it varies from 0 to as much as eight feet under the surface.

SOILS AND CONSTRUCTION

The soil under a foundation must be stable enough to hold up the load of the structure built on it. It must not erode or wash away, and it must be kept from the heaving caused by frost or changes in the amount of water in the soil. Soil must not settle too much or unevenly. This would cause the structure to crack.

Soil is often used as a construction material in earth dams and in fill or embankments. It must be stable and not heave or settle too much. It must be placed so water can drain out to make sure the soil will perform as it should, it must be engineered.

SOIL ENGINEERING

From the soil tests and the laboratory research reports, the construction consultant engineers the soil. Engineering of soil takes in how soil will be excavated and placed. The tests help the consultant detail specifications of how much compaction or pressure is needed to reduce the voids between the grains of soil. In addition, he measures for control of water, to combat frost heave, the slope of a fill, and considers how the soil is made up. All unsuitable soil material might be removed and replaced with a better material high in sand content. A designer plans for soil drainage by putting in underground drains.

The construction consultant or engineer also checks to see what the structure will do to the soil. In the case of foundations, he figures how much pressure or weight the soil can hold without giving in. An engineer may decide that the soil is so soft that piling down to the bedrock is needed. Based on the strength of the soil, design of the structure may begin.

SUMMARY

Soil is tested to see just what it is like. This is done because structures must have firm soil on which to rest. Soil tests are made for strength, water in the soil, compressibility, and other things. There are many kinds of soils with different characteristics. Soil must be researched and engineered before the structure can be designed. A construction consultant uses facts about soil so he can get it ready for the structure.

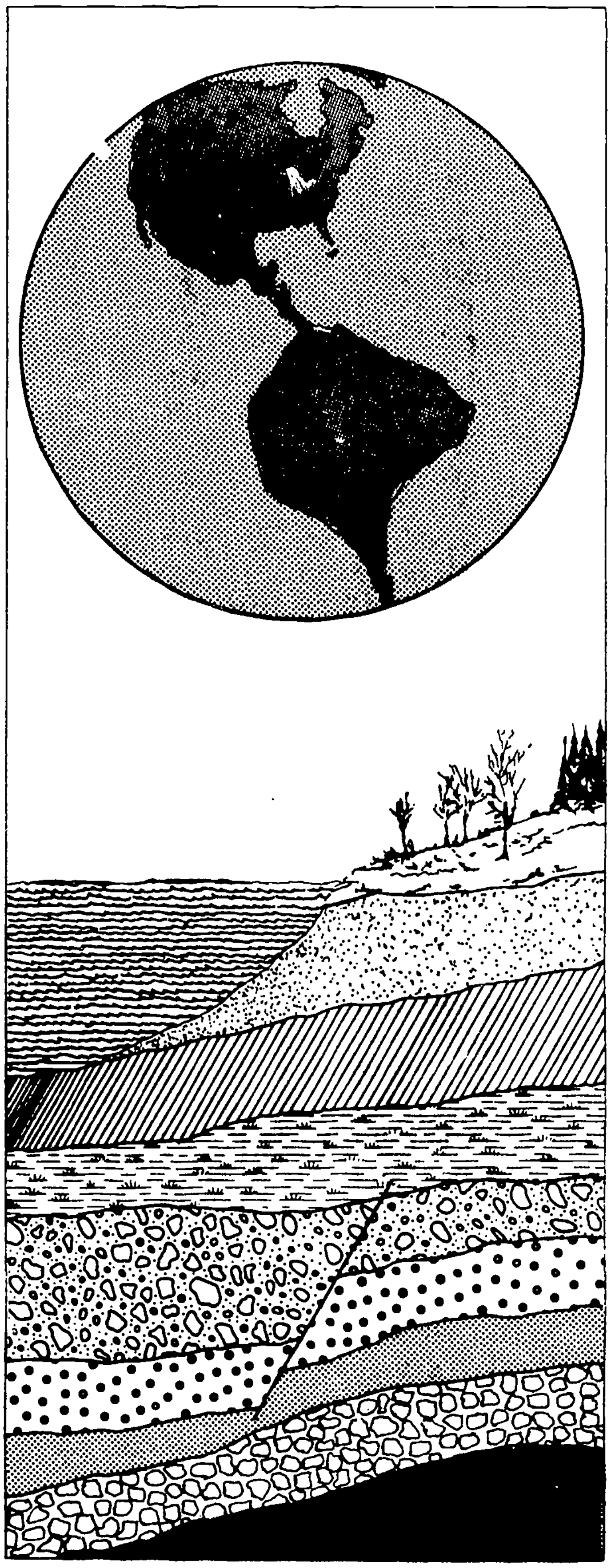
What construction personnel do to learn about soils is much like actions taken many times in the construction process. Researching means retrieving information about soils, describing soils and experimenting to get information that was not available on soils. This information from researching affects the designing and engineering of soils. These same actions in researching are used again and again in the construction process. For example, retrieving, describing, and reporting are used to provide information or data on concrete, structures, electrical systems, and paints.

Exhibit 2

Reading 9

Soil Testing

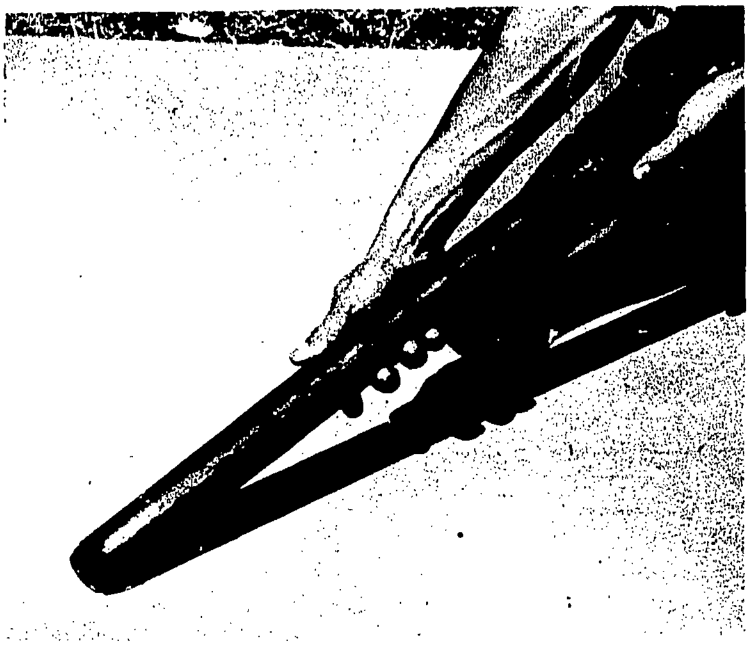
You have read how land surfaces are measured and described. This assignment will help you understand the characteristics of the soil which forms the upper layer of the earth. Soil sometimes is used in the construction of a structure such as an earthen dam. Generally, however, soil provides the load-bearing surface upon which the foundation of a structure rests. No matter what the structure may be, it must have a strong and sturdy foundation. To be sure of the strength and stability of the foundation, the construction designer must know the characteristics of the soil where the foundation is to be built.



The Earth's Crust

The crust of the earth is made up of rock and soil. Since rock is a hard material, it requires great force to excavate or remove it. There are several kinds of rock. Bedrock is under all of the earth's surface. In some cases, it is deeply below the earth's surface. In other cases, it is exposed and can be seen on the surface. Boulders are large, loose pieces of rock. They are from about eight inches to many feet in diameter. Cobbles are smaller pieces of rock. They are about four inches to eight inches in diameter.

Soil is composed of loose parts of the earth's surface. It is made up of grains of different sizes. Gravel is in



A split-spoon core container with both halves together is shown in this photograph. (Photograph courtesy of Soiltest, Inc.)

The split-spoon container with one half removed shows the soil sample. (Photograph courtesy of Soiltest, Inc.)

pieces which range from the size of peas to the size of cobbles. Grains of sand range from the size of granulated sugar to the size of peas. The texture of silt varies from that of powdered sugar to that of granulated sugar. Clay is of a very fine, powder-like texture, much like that of flour.

Most soil is made up of various textures--from that of fine clay to large boulders. For example, a so-called silt may be made up of 75 percent silt, 15 percent clay, and 10 percent sand.

Topsoil is the soil which lies near the surface of the earth. It is generally covered with grass, crops, or weeds. It is a mixture of soil and decayed vegetable matter.

Soil Characteristics

Different soil has different characteristics. Some characteristics depend on the soil particles. Other characteristics depend on the action of water on the soil particles. Soil particles are not smooth like marble. They are different in size and shape. Sometimes they are rounded. More often they are jagged with sharp corners. Because of the way they are shaped, they do not fill the whole space they are in. There are spaces between the particles which are called voids.

Much soil, especially clay, is quite cohesive. This means that the grains stick together. In fact, some kinds of soil stick together so strongly that they are nearly like cement. This kind of soil is almost as hard to work with as solid rock. Other clays often are plastic. They can be molded into different shapes very much like modeling clay can be molded.

When the grains have large spaces or voids between them, the soil is called loose. When the voids are small, loaded onto trucks. Then it might be placed in a foundation for a building where it might be placed under pressure to reduce the voids or spaces between the grains. After this is done, it might be only 85 cubic yards.

A soil tester is performing a sand density test. (Photograph courtesy of Soiltest, Inc.)

Soil Analysis

On large projects, or when there is unusual soil drainage or groundwater problems, specialists, who know about soil, may be hired to do a soil analysis. They study the soil and make recommendations about how to work with it.

There are many ways to get information about what kind of soil or rock is under the surface of the ground. The cheapest way is to find out what is already known about the soil. This is done by checking with government agencies, the owner of the property next to the one in question, drillers, and soil laboratories to see if they already have facts about the soil under study. Another inexpensive method used to analyze soil is to look at and feel the type of rock or soil which is on top of the earth's surface.

Sometimes water is pumped into the soil to see how hard the soil is and at what depth the bedrock lies. Holes may be bored with drills. By seeing the type of soil which comes out of the hole, it is possible to tell what kind of soil is at different depths in the ground. Some drills are made so that they bring up to the surface a cylindrical sample (shaped like a round pencil) or core of the soil. These cores may be sent to a laboratory for analysis.

Sometimes, large holes are dug in the ground so the soil tester may look at and take samples of the soil at various depths. These holes, which are dug by hand or machinery, are called test pits.

The soil tester is preparing to record data out in the field. (Photograph courtesy of Soiltest, Inc.)

A laboratory technician is preparing a core sample of cohesive soil for determining its shear strength. (Photograph courtesy of Soiltest, Inc.)

A shear strength testing device is being mounted in a soil sample. (Photograph courtesy of Soiltest, Inc.)

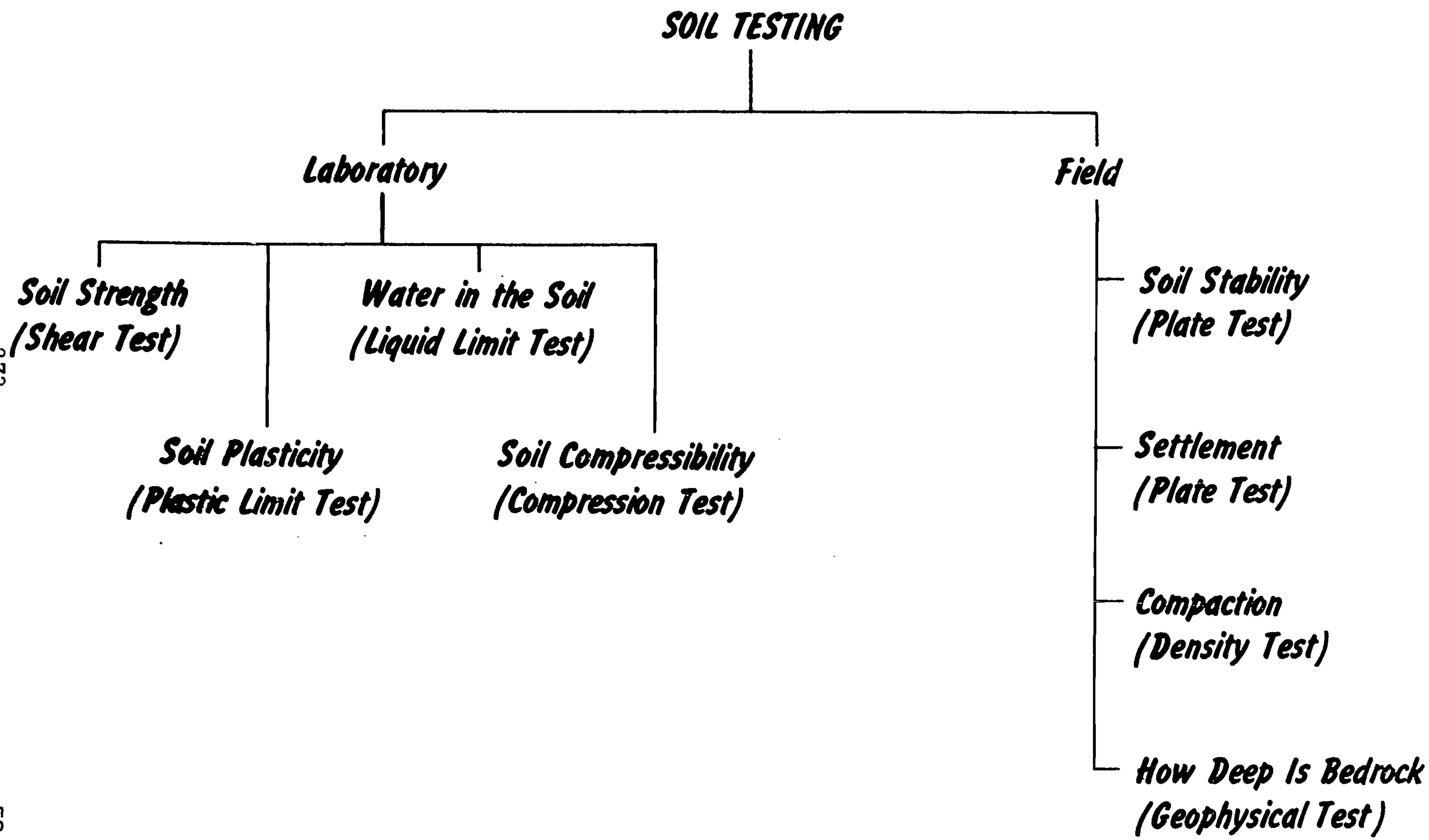

SOIL TESTING
Laboratory
Field
Soil Strength
(Shear Test)
Water in the Soil
(Liquid Limit Test)
Soil Plasticity
(Plastic Limit Test)
Soil Compressibility
(Compression Test)
Soil Stability
(Plate Test)
Settlement
(Plate Test)
Compaction
(Density Test)
How Deep Is Bedrock
(Geophysical Test)

Exhibit 3

Most soil is made up of textures varying from that of fine clay to large boulders. For example, a so-called silt may be made up of 75% silt, 15% clay, and 10% sand.

Topsoil is the soil which lies near the surface of the earth. It is generally covered with grass, crops, or weeds. It is a mixture of soil and decayed vegetable matter.

Soil Characteristics

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Much soil, especially clay, is quite *cohesive*. This means that the grains stick together. In fact, some kinds of soil stick together so strongly that they are nearly like cement. This kind of soil is almost as hard to work with as solid rock. Other clays often are plastic. They can be molded into different shapes very much like modeling clay can be molded.

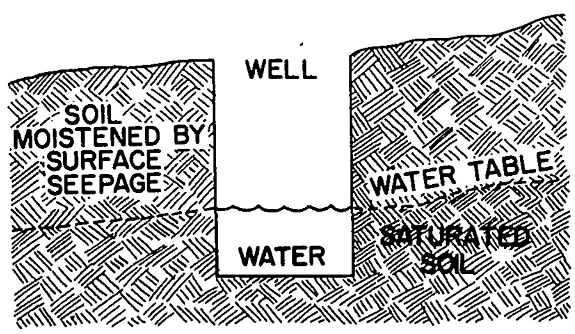


Fig. 9-2. The water table generally follows the surface contour of the land. In different parts of the country the water table is found at different depths from the surface.

When the grains have large spaces or voids between them, the soil is called *loose*. When the voids are small, the soil is called *dense*. Density can be made greater by putting pressure or weight on soil. Most soil is compressible. This means that it can be *packed down* or *compressed*.

The characteristics of soils depend a great deal on the amount of water which they contain. This water is of two kinds. At least a small amount of water from surface seepage (drainage) is in the spaces between grains of nearly all soils. In addition, there are rivers and lakes of water under the surface of the ground. This water fills and flows through the spaces between the soil grains. The top of this underground water, which can be found by digging an open pit, is called the *water table*, Fig. 9-2. The water table is not flat like the surface of an aboveground river or lake. Instead, it is found at differing depths from place to place around the world. It generally follows the surface contour of the land. Like surface water, most of this water is in motion or has a current.

In general, most soil (especially that with a lot of clay in it) swells as moisture is increased and shrinks when it is taken away. Some clay *slakes* (turns into a soft mass) when it becomes wet. A firm clay may lose its strength when there is water in it.

When water freezes and becomes ice, it expands and takes up more space. If the water in the soil freezes, the soil also expands and takes up more space. This raises the surface of the ground. Then, when the ice thaws, water forms and the soil becomes very wet. The depth of frost in the ground depends on the weather.

When most soil is excavated or dug up, it expands or swells. This happens because, when soil is disturbed, air gets into the spaces between the particles. One hundred cubic yards of a certain soil in its natural state might become 114 cubic yards if it were taken out and loaded onto trucks. Then it might be placed in a foundation for a building where it might be placed under pressure to reduce the voids or spaces between the grains. After this is done, it might be only 85 cubic yards, Fig. 9-3.

Soil Analysis

On large projects, or when there are unusual soil drainage or groundwater problems, soil specialists may be hired to do a *soil analysis.* They study the soil and make recommendations about how to work with it, Fig. 9-4.

Fig. 9-4. A soil tester is using a pocket penetrometer to check soil strength and its classification.

There are many ways to get information about what kind of soil or rock is under the surface of the ground. The cheapest way is to find out what is already known about the soil. This is done by checking with government agencies, the neighboring property owners, drillers, and soil laboratories to see if they already have facts about the soil under study. Another inexpensive method used to analyze soil is to look at and feel the type of rock or soil which is on top of the earth's surface.

Holes may be bored with drills. By seeing the type of soil which comes out of the hole,

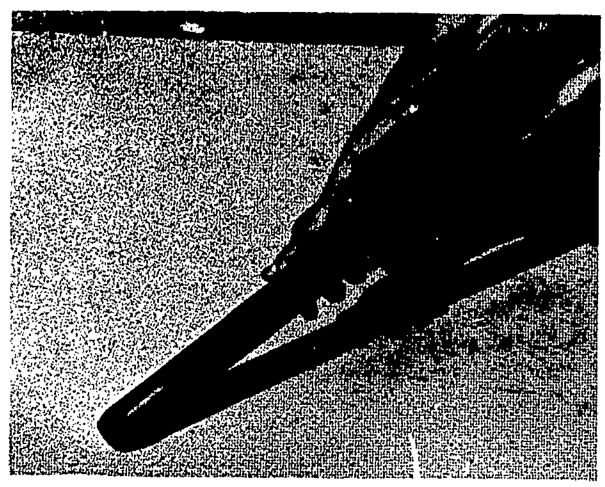


Fig. 9-5. A split-spoon core container with both halves together is shown here.

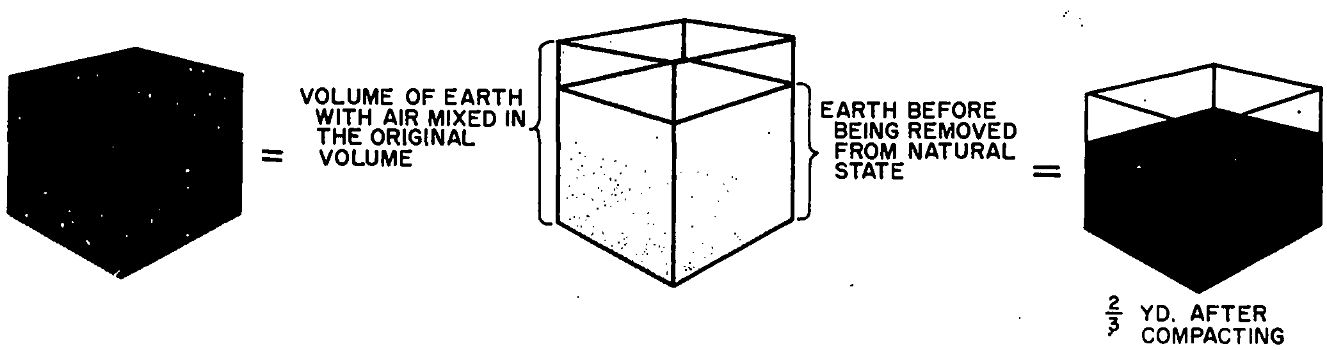


Fig. 9-3. When soil is removed from its original position, it is loose because of the air it now contains. Also, it has become large in volume (amount). When the soil is packed to hold a load bearing surface (a foundation), it then becomes smaller in amount.

it is possible to tell what kind of soil is at different depths in the ground. Some drills are made so that they bring up to the surface a cylindrical sample (shaped like a round pencil) or core of the soil, Figs. 9-5 and 9-6. These cores may be sent to a laboratory for analysis.

Sometimes, large holes are dug in the ground so the soil tester may look at and take samples of the soil at various depths. These holes, which are dug by hand or machinery (Fig. 9-7), are called *test pits*.

Soil tests in the field are of two different kinds. First, there are *plate bearing tests*. In these, heavy weights are placed on about four square feet of the earth's surface. The tester then observes the vertical and horizontal stability of the soil. That is, he measures how much the load tilts or leans. Also, he measures how much the load sinks into the soil. These are measures of *soil stability* and *settlement*. Second, there are *density tests*. Soil is put in a standard cylinder and is hit with a certain number of blows

Fig. 9-6. The split-spoon container with one half removed shows the soil sample.

Fig. 9-8. A soil tester is performing a sand density test.

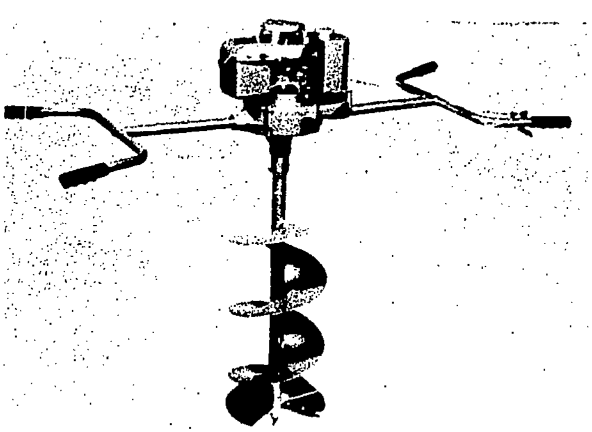


Fig. 9-7. An auger powerhead is used for large diameter or deep hole drilling to obtain soil samples.

Fig. 9-9. A laboratory technician is preparing a core sample of cohesive soil for determining its shear strength.

electrical resistance of the ground often are used. They are very helpful in finding how deep the bedrock is buried below the surface, Fig. 9-13.

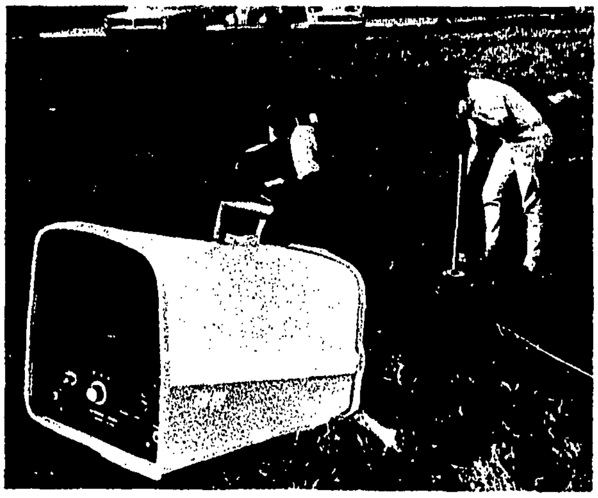


Fig. 9-13. Here soil testers are performing a geophysical test using a seismograph to determine how deep the bedrock is beneath the soil.

Soil and Construction

The soil under a foundation must be stable enough to hold up the load of the structure which is built on it. It must not erode or wash away, and it must be kept from heaving as a result of freezing or extra water in the soil. Soil must not settle too much or unevenly. This would cause the structure to crack.

Soil is often used as a construction material in making earthen dams. It must be stable and not heave or settle too much. It must be placed so water can drain away without eroding the fill. In addition, when trenches are dug, some soils need to be held in place by supports which are called *shoring*, Fig. 9-14. This keeps them from caving in or falling on the workers. *Firm soil* may not need to be shored. Excavating crews must know with which soil type they are working to prevent dangerous caving in.

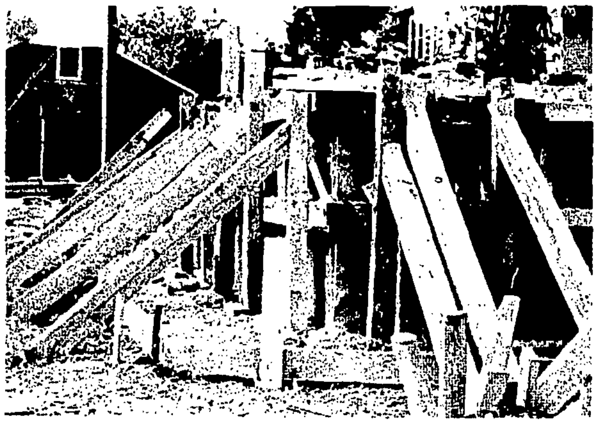


Fig. 9-14. Shoring is used to hold soil in place.

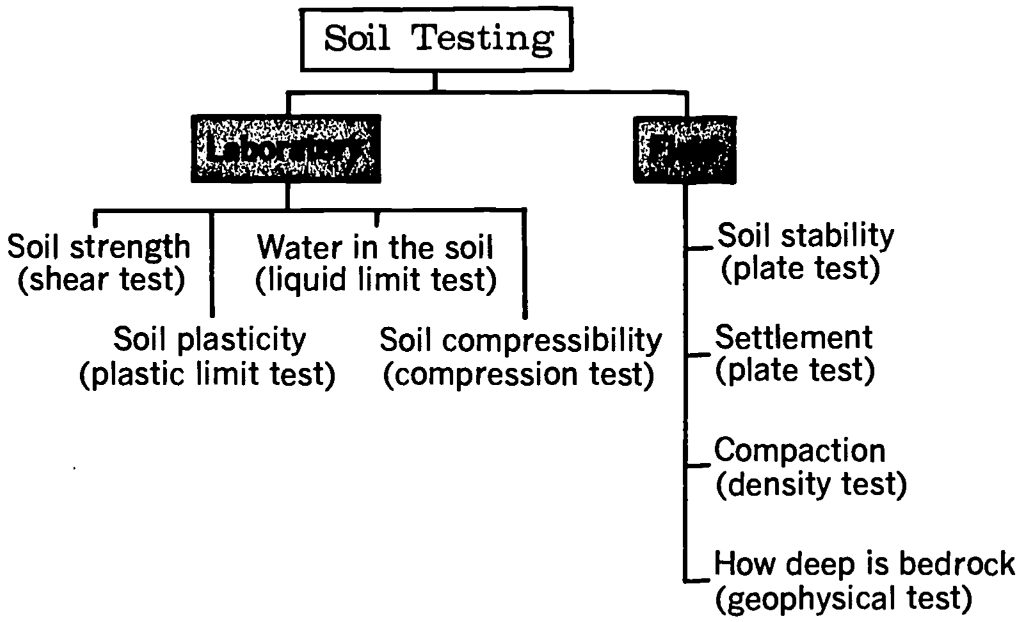
Soil Engineering

From the soil tests and the laboratory reports, the construction consultant determines how the soil in its natural state will be affected by the structure. He also decides what has to be done to or with the soil to take care of the needs of the structure and the safety of the workers. Sometimes a large amount of soil must be removed and replaced by soil which is better for use. In other cases, pressure must be applied by heavy rollers to reduce the spaces or voids between the grains of the soil so that it can hold a greater load. Often the composition of the soil itself is changed by adding a different type of soil or even some other substance, such as cement, to it.

The construction consultant decides how steep the man-made slopes should be. He also decides how to take care of extra water and how to prevent *frost heave*. In the case of foundations, he determines how much weight the soil can hold without collapsing or settling too much or too unevenly. He may even find that the soil is so soft that pilings must be put in for support. Based on the strength of the soil, a design for the structure may now begin.

Summary

In this assignment you have read that the earth's crust is made up of rock and soil. Characteristics of various types of soil have been described. The designer or soil consultant tests the soil and decides what needs to be done with the soil so it will support the structure that is being planned.



Terms to Know

voids	cubic yard
bedrock	analysis
topsoil	sample
slakes	stability
cohesive	laboratory
loose soil	geophysical
dense soil	shoring
compress	piling
water table	

Think About It!

1. Describe the soil in your community.
2. How does the soil in your community affect the following:
   a. water supply
   b. building foundations
   c. basements
   d. roadways
   e. drainage
   f. plant growth

APPENDIX E

Summary Sheets for Doctoral and Master's Studies In Industrial Arts Education

Author: Asper, Norman L.

Exact Title: THE RELATIVE CONTRIBUTIONS OF OVERT AND COVERT ACTIVITY TO THE LEARNING OF A PRAXIOLOGICAL CONCEPT

Degree Granted: Ph.D. Date: 1969 No. of Pages: 140

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

To determine the relative contributions of both overt and covert activity to the learning of an industrial praxiological concept.

Source of Data and Method of Study:

Five junior high school industrial arts classes were randomly assigned to five treatment groups. Each group received the same content presentation via videotape. After the presentation each group was provided varying amounts of time to conceptualize the activity (covert activity) and to practice the activity (overt activity).

Findings and Conclusions:

The evidence obtained from the analysis of data indicates that praxiological learning increases with an increase in the percentage of time spent in overt activity. The amount of increase, however, ceases to be significant as the percentage of time spent in overt activity approaches 80. It can be generalized, therefore, that to obtain the highest degree of learning for this particular praxiological concept (setting the gap of a spark plug) the percentage of time that should be spent at overt activity should exceed 60.

Author: Caley, Paul Cochran

Exact Title: AN EXPERIMENTAL ANALYSIS OF THE DIFFERENTIAL EFFECTS OF LECTURE-DISCUSSION AND LABORATORY ACTIVITY ON THE MORE COMPLETE UNDERSTANDING OF TECHNOLOGICAL CONCEPTS LEARNED IN WRITTEN MATERIALS

Degree Granted: Ph.D. Date: 1969 No. of Pages: 228

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

To ascertain the value of textbook materials, non-written, verbal learning materials, and laboratory activity toward the objective of learning concepts inherent in industrial technology.

Source of Data and Method of Study:

Four groups of 26-29 eighth grade students were selected. Each group was exposed to four 30-minute text readings and workbook questions. In addition, a second group was exposed to 15 minutes of lecture-demonstration, a third group to laboratory activity for 35 minutes and a fourth group to both lecture-demonstration and laboratory activity.

Findings and Conclusions:

Three conclusions were drawn concerning industrial technological concept learning with adolescent-age children. First, once a certain number of concepts are mastered from written learning materials, an additional exposure to learning modes of the lecture-discussion and laboratory activity type do not have a significant effect on the learning of additional concepts. Second, there is no substantial evidence to support the contention of superiority of lecture-discussion over laboratory activity or vice versa, nor is there an advantage in adding either or both types of activities to a school program. Third, written learning materials are a more efficient means of learning concepts than lecture-discussion and laboratory activity, singly or in combination.

Author: Clark, Donald Lee

Exact Title: ACTIVITY AND LEARNING: AN EXPERIMENTAL COMPARISON TO DETERMINE THE EFFICACY OF OVERT VERSUS COVERT ACTIVITY ON THE LEARNING OF AN INDUSTRIAL PRAXIOLOGICAL CONCEPT

Degree granted: Ph.D. Date: 1967 No. of Pages: 183

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. ( )

Purpose of Study:

To help in the formulation of a sounder theory about the efficacy of overt versus covert activity of the learning of an industrial praxiological concept.

Source of Data and Method of Study:

Two methods of instruction were used in teaching an industrial praxiological concept to 142 junior high school boys in seven separate industrial arts classes. Each class was given the same basic presentation via video tape. This was followed by one-half of the students in each class conceptualizing about how to "do" the activity while the other half actually practiced the activity. Evaluation of each method of instruction was achieved by means of analyzing the performance of each group on a performance test.

Findings and Conclusions:

1. The findings revealed that the student who had had the overt practice outperformed the student who had only conceptualized about the activity. This finding was substantiated on overall achievement as well as on part scores.
2. A further finding that substantiated the need for and value of practice was that as the group which had conceptualized completed successive units--each unit being a form of practice--their mean achievement became more nearly that of the practice-performance group.
3. Of seven ability factors, each had a positive effect in that the higher the individual student ability, the higher his achievement on the praxiological concept.
4. I.Q. did not appear as a significant factor.

5. The overall findings of the study indicated that in teaching a praxiological concept, the emphasis should be placed on overt activity.

Author: D'Ambrosio, Vincent C.

Exact Title: COMPARATIVE PSYCHOMOTOR ACHIEVEMENT IN TWO INDUSTRIAL ARTS COURSES

Degree Granted: Ph.D. Date: 1969 No. of Pages: 254

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. ( )

Purpose of the Study:

The purpose of this study was to determine what differences there are between the psychomotor achievement of students completing a traditional seventh grade industrial arts course and the psychomotor achievement of students completing a "World of Construction" course.

Source of Data and Method of Study:

Three groups of seventh grade boys were used for this study: one group was enrolled in the "World of Construction", Industrial Technology I" course; one group was enrolled in a conventional industrial arts course; and one group without any previous junior high school industrial arts experience was included in the study.

To obtain the data necessary to evaluate the treatment received by each group, a manipulative - performance achievement test was developed; this included five manipulative skills common to both industrial arts courses. The test also obtained measurements of students' intervening achievement factors: the ability to read a working drawing, to read a rule, and to make linear measurements.

Finding and Conclusions:

1. There was no significant difference for spatial perception achievement between two industrial arts groups in the same school district. However, there was a significant difference between the students in the industrial arts group and students in the control group.

2. There was no set pattern for correlation between intervening achievement factors and the students' performance on the different manipulative activities.

3. There was no set pattern for correlation between the students' performance on one specific operation and their performance on other operations.

Author: Doty, Charles Ransom

Exact Title: THE EFFECT OF PRACTICE AND PRIOR KNOWLEDGE OF EDUCATIONAL OBJECTIVES ON PERFORMANCE

Degree Granted: Ph.D. Date: 1968 No. of Pages: 284

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

To investigate and to provide evidence relevant to the effectiveness of two strategies of instruction as measured by immediate learning: (1) providing or withholding prior knowledge of educational objectives, and (2) providing practice on the actual referent (object) and the symbolic referent (written description).

Source of Data and Method of Study:

In this study a completely randomized factorial design was used, R Y1 X Y2. Following this design the teachers randomly assigned the four treatments (combinations of the two main variables, knowledge of educational objectives, and practice on referents) to classes; administered a pretest; taught a rigidly structured instructional unit; and administered a posttest. Seven schools from a large city were sampled, one class from each school. There were 190 subjects sampled; 45 subjects received each of the four treatments.

Findings and Conclusions:

The evidence presented in this study points to the fact that the possession of prior knowledge of educational objectives before studying an instructional unit does increase the efficiency in student learning, and that practicing on the actual referent rather than the symbolic referent produced some effect on learning but not a significant effect.

The inference was made that the schools do have differing student populations and, therefore, the results of the study had generalizability. Of the other individual differences studies, e.g., age, interest, school grades, standardized test scores, or I.Q., only the student's industrial arts grade had a significant effect upon test scores obtained in this city.

Author: Dugger, Jr., William E.

Exact Title: A STUDY OF THE COMPARISON OF THE ACHIEVEMENT OF INDUSTRIAL ARTS CURRICULUM PROJECT STUDENTS WITH TRADITIONAL INDUSTRIAL ARTS STUDENTS

Degree Granted: Ph.D. Date: 1970 No. of Pages: 139

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of the Study:

The purpose of this study was to compare the cognitive achievement of Industrial Arts Curriculum Project students enrolled in "The World of Construction," with students in traditional industrial arts courses.

Source of Data and Method of Study:

This study involved 287 seventh grade students from the Columbus, Ohio, public and parochial schools. The students were divided into three groups: Group A was enrolled in "The World of Construction" course; Group B was enrolled in traditionally-taught industrial arts courses; and Group C was not involved in any industrial arts courses.

Two achievement test instruments were used for gathering data. The General Industrial Arts Test (Form A of E.T.S.) assessed student performance on traditionally-taught industrial arts content. The World of Construction Comprehensive Examination II, assessed student performance on the innovative industrial arts content.

Findings and Conclusions:

1. Industrial Arts Curriculum Project students performed significantly better than traditionally-taught students on "The World of Construction" Comprehensive Examination II.
2. There was no significant difference among the three groups of students on the General Industrial Arts Test.
3. There was no significant difference in the mean achievement scores of the two industrial arts groups on the four sub-test areas of the General Industrial Arts Test.

Author: Fazzini, Phillip A.

Exact Title: A COMPARATIVE STUDY TO DETERMINE THE EFFICACY OF TWO INDUSTRIAL ARTS PROGRAM APPROACHES UPON PUPILS' ATTITUDES TOWARD MANUFACTURING INDUSTRY

Degree Granted: Ph.D. Date: 1970 No. of Pages: 192

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

The purposes of this study were: (1) to develop and standardize a reliable instrument to measure pupils' attitudes toward manufacturing industry, and (2) to compare the Industrial Arts Curriculum Project "The World of Manufacturing" with a conventional industrial arts program.

Source of Data and Method of Study:

There were 128, eighth grade students from three different schools in Cincinnati, Ohio, involved in this study. The students were divided into three groups who were enrolled in (1) a conventional industrial arts program, (2) "The World of Manufacturing" program, and (3) a parochial school having no industrial arts program.

Items used in the construction of the attitude scale were obtained from five broad practices and curriculum objectives of industrial arts content. The attitude scale was administered to all three groups.

Findings and Conclusions:

It was found that the conventional method of teaching industrial arts is more successful in fastening positive attitudes toward:

1. the manufacturing industry
2. automation and occupation aspects of manufacturing industry
3. working conditions and production aspects of manufacturing industry

It was believed that the innovative industrial arts groups, exposed to a more realistic representation of modern industry, were more objective toward the attitude scale items.

Author: Hauenstein, Albert Dean

Exact Title: CONSTRUCTION: A TAXONOMY AND SYLLABUS OF PRODUCTION PRACTICES WITH IMPLICATIONS FOR INDUSTRIAL ARTS

Degree Granted: Ph.D. Date: 1966 No. of Pages: 219

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. ( )

Purpose of Study:

In conjunction with the Industrial Arts Curriculum Project, the purpose was to develop a taxonomy of construction practices man uses to change the form of materials on a site, and to develop a model syllabus exemplifying the construction of any structure.

Source of Data and Method of Study:

The taxonomy was generated by researching, conceptualizing, and structuring construction practices into a hierarchy under the headings: preprocessing, processing, and postprocessing. The model syllabus was developed by analyzing, synthesizing, and structuring construction practices and processes which apply to the construction of any structure. The taxonomy and syllabus were validated by a panel of construction experts.

Findings and Conclusions:

The following are the major divisions of the taxonomy:

1. Preprocessing: worker control--locating, controlling, positioning, and material handling.
2. Processing: separating, forming, and combining.
3. Postprocessing: repairing; altering; installing; maintaining.

The following are the major divisions of the syllabus titles:

1. Prepare the Site: Clearing the site; setting up temporary facilities, surveying for construction; earthworking.
2. Building the Structure: Setting foundations, building the major structural elements; installing circulatory systems, finishing the structure.
3. Completing the Site: Landscaping; removing temporary facilities.
4. Postprocessing: Repairing, altering, installing, maintaining the structures.

Sample instructional materials were developed from the taxonomy and syllabus to serve as a guide in developing a junior high text, workbook, laboratory manual, achievement tests, teacher's guide, laboratory activities, and teacher's bibliography.

Author: Hyder, Carroll Ray

Exact Title: AN ASSESSMENT OF THE EFFECTIVENESS OF SUMMER WORKSHOPS FOR TRAINING TEACHERS TO USE THE MATERIALS OF THE INDUSTRIAL ARTS CURRICULUM PROJECT

Degree Granted: Ph.D.   Date: 1971   No. of Pages: 200

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

The purpose of this study was to assess the effectiveness of the Industrial Arts Curriculum Project Summer Workshops for Construction Teachers and to collect data and information to further enhance the effectiveness of such programs in the future. A second purpose of the study was to determine the job satisfaction of teachers completing the training program.

Source of Data and Method of Study:

The population for the study consisted of all teacher trainees participating in the 1970 IACP Summer Workshops for Construction Teachers. A sample was selected consisting of 154 teacher trainees from nine of the workshops. Three instruments were used to assess the effectiveness of the workshops. An achievement test was used to test subject matter achievement, the Minnesota Satisfaction Questionnaire was used to assess job satisfaction, and a participant follow-up questionnaire was sent to participants. The research design for the IACP content and process achievement segment was a separate sample, pretest, posttest design without randomization.

Findings and Conclusions:

1. A significant increase was formed in teachers' knowledge of IACP Content and Process.
2. The criterion group of experienced IACP teachers scored significantly higher on the achievement pretest than did the experimental trainee group.
3. The mean achievement pretest score of the criterion group of experienced IACP teachers was significantly higher than the mean score of the experimental trainee group.
4. There was no significant difference in job satisfaction between the trained group that elected to teach the IACP program and those

who did not.

5. It was concluded that the IACP workshops were relatively successful in achieving their expressed purpose and objectives.

Author: Kuwik, Paul David

Exact Title: A QUASI-EXPERIMENTAL STUDY OF TWO SELECTED UNITS OF THE INDUSTRIAL ARTS CURRICULUM PROJECT MATERIALS TO DETERMINE THE MEASURABLE ADDITIVE EFFECTS OF A UNIT ON DESIGN IN MANUFACTURING TECHNOLOGY UPON A SIMILAR UNIT ON DESIGN IN CONSTRUCTION TECHNOLOGY

Degree Granted: Ph. D. Date: 1970 No. of Pages: 182

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

The purpose of this study was to determine what additive effects exist in a unit on design offered during the eighth grade course in manufacturing technology upon a unit on design offered during the seventh grade scourse in construction technology.

Source of Data and Method of Study:

An achievement test designed to measure "The Technological Principles of Design" was developed and pilot-tested with a group of 127 students. Based upon the results of item analysis, the instrument was refined and then administered to four treatment groups in one IACP evaluation center. The four groups were (1) an experimental group of eighth grade IACP students exposed to the design units on construction technology in the seventh grade and manufacturing technology in the eighth grade; (2) an experimental group of seventh grade IACP students exposed to the design unit in construction technology but not to the design unit in manufacturing technology; (3) a control group of eighth grade students enrolled in a conventional program of industrial arts with no exposure to the design units in construction or manufacturing technology; and (4) a control group of seventh grade students enrolled in a conventional program of industrial arts with no exposure to the design in construction or manufacturing technology.

Student ability scores were determined from the Herman Nelson Test of Mental Ability. Hypotheses were then presented which predicted the significant additive effects between the treatment groups and interaction between achievement and ability. The data were analyzed using ANOVA, ANCOV, and Duncan's Multiple-Range Test.

Findings and Conclusions:

The results of the analysis indicated that there was a significant amount of additive knowledge when students had been exposed to two units in design, one in construction technology and one in manufacturing technology, as opposed to only one exposure of construction technology. Statistical analysis also indicated a significant difference between the achievement scores of the seventh grade control group and the seventh grade experimental group, with the latter group achieving at a higher level. There were no significant additive effects between the scores of the eighth and seventh grade control groups.

After the four treatment groups were stratified into three levels of high (141-111), medium (110-98), and low (97-65) ability, analyses indicated that there was no significant interaction between treatment and ability levels within the control group cells. Statistical analyses also indicated that there was no significant interaction between the experimental groups of high and medium ability levels. Significant interaction was evident within the experimental cells of the low ability level.

The findings indicated that the technological concepts and principles of design are significantly additive when a second design unit (in "The World of Manufacturing") is provided to build upon the concepts provided by a prior design unit (in "The World of Construction"). When the cell groupings of high, medium, and low ability were explored, the findings further indicated that there is significant interaction within the low ability level cells of the experimental groups.

Author: Mason, Emmett Elwell

Exact Title: THE ASSOCIATIVE MEANING AND CONTENT VALIDITY OF SELECTED ELEMENTS FROM THE INDUSTRIAL ARTS CURRICULUM PROJECT'S TAXONOMY AS DETERMINED BY CONTINUED WORD ASSOCIATION

Degree Granted: Ph.D. Date: 1969 No. of Pages: 125

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

1. To determine the associative meanings which were held by manufacturing management personnel for 14 selected management concepts.
2. To determine the principal relationships of work association responses to each management concept.
3. To compare these principal relations to the concepts in order to determine their content validity.

Source of Data and Method of Study:

Word association data were collected in written form by the use of a controlled, continued word association technique involving a mimeographed booklet containing the concepts in random order and a tape recording containing directions and timed bell tones. The word association responses were subjected to an inspective analysis and a statistical analysis.

Findings and Conclusions:

Twelve stimulus words elicited response words which related them to the other stimulus words, to other more specific IACP management concepts, and to the factor structure. From this it was concluded that managing, planning, organizing, controlling, formulating, researching, designing, engineering, structuring, directing, monitoring, and reporting were valid for continued use in the IACP curriculum taxonomy. The stimulus word supplying did not elecit response words which related it to the factor structure. Dominant responses did not appear in the response distributions of planning, researching, and correcting. The stimulus word correcting did not elicit enough other management concepts as response words to allow its inclusion in the factor structure to be considered as an indication of its validity.

Author: Miller, David Ellis

Exact Title: AN ANALYSIS OF OCCUPATIONAL INFORMATION CONTAINED IN THE INDUSTRIAL ARTS CURRICULUM PROJECT "THE WORLD OF CONSTRUCTION"

Degree Granted: M.A. Date: 1969 No. of Pages: 174

Granted by The Ohio State University

Where Available: OSU Library

Purpose of Study:

The major purpose of this descriptive study was to identify the occupations represented in "The World of Construction" student textbook and laboratory manual; to determine the occupational information presented for each occupation; the adequacy of that information; and the representation of the occupations of the construction industry.

Source of Data and Method of Study:

Research was conducted to determine what information existed in the process career development and the type of occupational information junior high students would need. A review of the student text revealed the occupations represented and titles identified from the Dictionary of Occupational Titles: Vol. 1, 3rd. ed., 1965. The information concerning occupations in the student text was identified and investigation of adequacy was conducted in both forms of information presented and representation of the construction industry.

Findings and Conclusions:

Of the 79 occupations found in the text and laboratory manual 39 were adequately defined; for the 41 remaining it was found that the scope of coverage was too narrow. This appeared to correlate with the laboratory activity.

Miller provides a summation of his findings as follows:

1. The major construction occupations in designing construction products and in the management of production of these products on site are well represented.
2. The major production occupations in building structures are well represented.

3. The occupational information for production occupations is mainly associated with building construction rather than non-building construction such as roads and dams.
4. The construction occupations in excavating, paving and grading are not represented because of the physical, student, and monetary limitations of the junior high school program.
5. The construction occupations in truck driving and moving and storing materials are not represented because of physical, student, and monetary limitations of the program.

Author: Miller, Larry Reed

Exact Title: 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

Degree Granted: Ph.D. Date: 1971 No. of Pages: 202

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

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.

Source of Data and Method of Study:

For this evaluation study, a posttest-only design was used with intact classroom groups in ten Field Evaluation and Demonstration Centers of the IACP and a comparable group of students taking conventional industrial arts. A total of 3128 students participated in the study. Four test instruments were used: two IACP comprehensive achievement tests, a conventional general industrial arts test developed by the Educational Testing Service, and an attitude scale. After the test returns were received by the investigator, samples were drawn that provided the data to answer the major questions of the study. The students' test scores were analyzed and adjusted statistically by using analysis of covariance in order to control for any initial variations existing in known factors related to the variables under study.

Findings and Conclusions:

The data obtained from this investigation were analyzed according to acceptable statistical methods. Based on this analysis, the researcher found:

1. Analyais of the data derived from students that completed The World of Construction Achievement Test-Comprehensive Exam re-

vealed 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.

2. The analysis of data of the sample of students that completed The World of Manufacturing Achievement Test-Comprehensive Exam revealed that the six groups were different in the level of cognitive achievement set forth. The "Manufacturing" students 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.

3. 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 set forth. However this difference was minimal in that the tested paried means, with one exception, were not statistically significant.

4. The analysis of data of the sample of students that 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, two groups were found to be statistically different from each other.

Author: Peter, Richard F.

Exact Title: THE DEVELOPMENT OF A COMPREHENSIVE ACHIEVEMENT TEST FOR THE WORLD OF CONSTRUCTION

Degree Granted: Ph.D. Date: 1970 No. of Pages: 223

Grantedby The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

The problem which became the focus of this study was to develop a comprehensive achievement test which would include items which represent all the major concepts of the construction course and would measure a student's grasp of relatively permanent knowledge. A majority of items would be based upon intermediate educational objectives which reflect the application, analysis, synthesis, and evaluation categories of Bloom's taxonomy.

Source of Data and Method of Study:

The procedures followed in arriving at a solution to the problem may be summarized as follows: (1) Major concepts of construction technology were identified; (2) An outline of each major topic was developed to show its principal subelements; (3) A set of intermediate objectives related to the major concepts were developed to bridge the gap between the broadly stated course objectives and the specific daily operational objectives; (4) A table of specifications was established as a blueprint for developing a test which would represent all the major concepts of construction technology and would also reflect higher level objectives; (5) Test items were written according to the table of specifications and criteria outlined in current literature in the field of educational measurement; (6) The first draft of the test was pilot tested with 66 boys in seventh grade construction classes in Evanston, Illinois; (7) An item analysis of the test was performed and revisions were made; (8) The revised test was administered to 116 boys in seventh grade construction classes in Cincinnati, Ohio.

Findings and Conclusions:

The rationale and structure developed in the course of this research effort provided a logically defensible structure for the development of a comprehensive achievement test in construction technology. The statistical analysis of the revised test suggests that the technique employed by the writer was successful in producing an achievement test with high discrimination, reliability, and validity factors.

Author: Rosser, Arthur James

Exact Title: AN EXPLORATORY STUDY OF USING A COMPUTER IN CURRICULUM DEVELOPMENT

Degree Granted: Ph.D. Date: 1968 No. of Pages: 113

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

This developmental study was conducted to determine the feasibility of using a computer to assist the curriculum maker during the curriculum development process.

Source of Data and Method of Study:

A sample computer program was developed and presented in detail through seven applications to the curriculum development process. The elements of a structured body of knowledge of industrial technology were used in the sample computer programs. The computer assisted in the areas of formulating objectives, providing curriculum content and experience combinations, and providing curriculum continuity checklists.

Findings and Conclusions:

The study showed computers were feasible, based on the following seven criteria:

1. time
2. cost
3. equipment
4. creativity
5. decision-making
6. inclusiveness
7. limitations

Author: Ruggles, Stanford Dean

Exact Title: PLACEBO PROGRAM BRANCHING AND LEARNER SELF-CONCEPTS

Degree Granted: Ph.D. Date: 1969 No. of Pages: 184

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

The problem of this study asked what relationships exist between two types of branching (placebo and nonplacebo) and students with high and low self-concepts.

Source of Data and Method of Study:

A sample of 173 seventh grade boys were used in this experimental study. The California Test of Personality was given to stratify the group into two sections, a high self-concept group and a low self-concept group. The groups were given a branching program. The programs were identical. The nonplacebo branching informed the student of incorrect choices and the other did not.

Findings and Conclusions:

A t-test was made to determine any significance between the means of the subgroups. This test revealed no significant difference between the high self-concept placebo and the nonplacebo groups. Consequently, the author's first hypothesis was upheld, but the second hypothesis was not upheld. Low self-concept students did not achieve significant scores using the placebo branching program.

A t-test comparing the scores of the high self-concept group (placebo and nonplacebo) with the scores of the low self-concept group (placebo and nonplacebo) revealed the high self-concept scores to be significantly higher at the .001 level of significance.

Author: Walgren, Floyd Bronson

Exact Title: A COMPARISON OF THE WRITTEN ACHIEVEMENT OF PUPILS IN TWO DISPARATE INDUSTRIAL ARTS SEQUENCES

Degree Granted: Ph.D. Date: 1971 No. of Pages: 118

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

To compare the written achievement of those students who have completed a two-year sequence of either of the two programs.

Source of Data and Method of Study:

Two equated eighth grade groups participated in the study. One was composed of students who had completed a two-year sequence of traditional industrial arts, and the other consisted of students who had completed a two-year sequence of IACP industrial arts. At the completion of their respective two-year sequences, both groups were administered two sets of achievement tests which evaluated the written achievement of each program. The means of each group's scores on each test statistically adjusted for any differences in IQ scores. The overall means were compared and the means of low, medium, and high IQ groupings also were compared.

Findings and Conclusions:

From the evidence reported in this study, the following conclusions have been drawn: (1) the mean scores of the students of both programs were at the same statistical level on the traditional test; (2) the mean scores of the IACP students were at a significantly higher level than were the mean scores of the traditional students on the IACP test; (3) the mean scores of all of the students in each IQ grouping were at the same statistical level on the traditional test; and (4) the mean scores of the IACP students in all IA groupings were significantly higher than were the mean scores of the traditional students, in each of the respective IQ groupings, on the IACP test.

It can be generalized that the individuals who complete the IACP program suffer no disadvantage as compared with those who take two years of traditional industrial arts. Further, the data suggest that the IACP students gain additional knowledge which is not gained by those who complete the traditional program.

Author: Weber, Robert David

Exact Title: THE INFLUENCE OF READING GRADE LEVEL ON THE READING COMPREHENSION OF BELOW GRADE LEVEL READERS PARTICIPATING IN THE INDUSTRIAL ARTS CURRICULUM PROJECT.

Degree Granted: Ph. D. Date: 1971 No. of Pages: 149

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

The primary purpose of this study was to determine if the reading comprehension of a group of below grade level readers participating in the Industrial Arts Curriculum Project could be increased significantly by lowering the reading grade level of technical reading materials.

Source of Data and Method of Study:

Two readings from one of the Industrial Arts Curriculum Project textbooks were selected and rewritten to a lower level of readability with the help of reading and writing specialists. The Fry Readability Graph was used to estimate the reading grade level of the rewritten materials. The rewritten readings were estimated to be within the fifth to sixth grade reading level while the standard readings were estimated to be within the eighth to ninth grade reading level.

A total of 116 eighth grade IACP students from two schools participated in the study. The average reading ability of the subjects, in terms of a reading grade equivalent measure, was 6.3. Students in each class received either the control group treatment (standard reading) or the experimental group treatment (reduced reading) through the process of randomization.

The cloze procedure of deleting every fifth word and replacing it with a standard size blank was applied to sections of each of the readings. The extent to which subjects replaced the exact word which had been deleted served as a measure of reading comprehension.

Findings and Conclusions:

Analysis of the data indicated that the reliability estimations of the cloze tests were fairly high (between .84 and .88) using the K-R 20

Formula. A series of t-tests showed the groups to be equatable in terms of reading comprehension ability. A series of t-tests also indicated that the cloze test mean of the experimental group was significantly higher than the cloze test mean of the control group. All hypotheses were tested at the .05 level of confidence, using a two-tailed test.

In view of the findings, the following recommendations were made:

1. If educators are concerned with making technical reading materials comprehensible to students with a wide range of reading abilities, consideration should be given to writing the material at a level of readability which is approximately at or below the measured average reading ability level of the group. Although there may be a limit to the simplification of written materials of a technical nature, the readability of the experimental materials can be improved without substantially changing the technical content.

2. In the process of writing technical materials which are designed for audiences with a wide range of reading abilities, more readable materials result from the cooperative efforts of subject-matter specialists and reading and writing specialists.

Author: Wenig, Robert E.

Exact Title: THE DEVELOPMENT AND TESTING OF AN INNOVATIVE TOTAL PROGRAM EVALUATION SCHEMA FOR INDUSTRIAL ARTS EDUCATION

Degree Granted: Ph.D. Date: 1970 No. of Pages: 412

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. (x)

Purpose of Study:

The main purpose of the study was to develop and test a total program evaluation schema for providing useful information to educational consumers about industrial arts programs.

Source of Data and Method of Study:

The procedure or method used to solve the problem was to develop a theoretical evaluation model to guide and direct the development of an operational evaluation model. This was accomplished by developing premises from the results of a survey instrument. The instrument statements were derived from the review of selected literature and pilot tested. The instrument was mailed to selected generalists in educational evaluation and industrial arts educators. The statements were rated on a Likert scale to determine what the respondents felt evaluation should be.

An operational evaluation model was constructed by applying the rationale from the selected theoretical evaluation model, a management decision process, and a systems theory technique. These three elements form the basis of an innovative evaluation schema.

An important part of the evaluation schema was the development of an overarching questioning process. It was designed to elicit questions that the evaluation schema should answer in providing useful information to the decision-maker.

Findings and Conclusions:

Within the limits of the study, the following conclusions were reached: (1) the survey instrument caused the respondents a measure of frustration which perhaps could have been corrected by using the research techniques of Q sort, factor analysis, or a clustering process; (2) the premises adequately provided the rationale for selecting the best theoretical model required for constructing the operational evaluation model; (3) the questioning matrix provided a systematic and logical means to identify the right questions; (4) by combining the knowledges from the selected theoretical evaluation model, the management decision process, and the systems theory approach an operationally sound total program evaluation schema was developed called IASIS; (5) IASIS was considered to be logical and operative as determined by experts in educational evaluation, systems theory, and industrial arts research; and (6) through simulation, IASIS was given an effective testing of its efficacy and provided a means for increasing its understandability.

Author: West, William E.

Exact Title: THE INFLUENCE OF THE INDUSTRIAL ARTS CURRICULUM PROJECT'S MATERIALS ON THE OCCUPATIONAL CHOICES OF 8TH GRADE MALE STUDENTS

Degree Granted: Ph.D. Date: 1969 No. of Pages: 166

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. ( )

Purpose of Study:

The purpose of this study was to compare occupational interest of students enrolled in "The World of Construction" with students taking a conventional industrial arts course.

Source of Data and Method of Study:

This study was conducted using three groups; one in IACP, one in a general shop, and one control group (receiving no industrial arts experience). The dependent variable was the Ohio Vocational Interest Test (OVIS) which measured the intensity of a student's interest in a particular vocational area.

Findings and Conclusions:

The groups were not randomly assigned, but matched by applying ANOV to their scores from standardized I.Q. reading and math examinations. Analysis of covariance was used to compare the results of the OVIS and the following results were noticed.

1. None of the groups scored significantly different on the OVIS.
2. The IACP group was extremely close to significance at the .05 level.

Author: Young, Darius Robert

Exact Title: THE DEVELOPMENT OF A CONSTRUCTION INDUSTRY INTEREST INVENTORY

Degree Granted: Ph.D. Date: 1968 No. of Pages: 221

Granted by The Ohio State University, Columbus, Ohio

Where Available: Microfilm (x) Microfiche ( ) E.R.I.C. ( )

Purpose of Study:

The main objective of the study was to develop a construction industry interest inventory covering practices of management, of production, and of personnel within construction industry technology.

Source of Data and Method of Study:

Construction industry practices would be ranked as "most interesting" to "least interesting". Two separate pilot studies were conducted for purposes of developing and refining the final form of the interest inventory. In its final form, the interest inventory was administered at the end of the 1967-68 school year to 892 junior high students who were participating in the first field study of the IACP.

Findings and Conclusions:

1. The construction industry interest inventory could be further refined by developing a large item-phrase pool, and by using higher discrimination indices to eliminate unfavorable items.
2. Additional studies could be conducted relating students' construction industry interests to social, economic, and cultural factors which might affect their interests.
3. A battery of interest inventories could be developed for industrial technology with the addition of an interest inventory covering manufacturing technology.
4. The construction industry interest inventory can be used by guidance counselors, curriculum developers, and job-placement advisors.

APPENDIX F

Students' Responses in Percentage Figures on the Construction and Manufacturing Student Questionnaires

THE WORLD OF CONSTRUCTION

Student Questionnaire Summary

1. Did you enjoy studying construction?

   Yes 81.9% No 8.0% Undecided 9.9%

2. Would you recommend this course to your friends?

   Yes 81.9% No 9.9% Undecided 8.0%

3. Do you think that seventh grade boys in all junior high schools should have a chance to study construction?

   Yes 85.2% No 7.2% Undecided 7.4%

4. Do you feel that you now have a good general understanding of many phases of construction?

   Yes 75.4% No 12.0% Undecided 12.4%

5. Do you feel that the experience you have had and the information you have gained in studying construction will be of value to you later in life?

   Yes 72.7% No 9.9% Undecided 17.2%

6. Do you think you might like to work in some phase of construction as an adult?

   Yes 40.5% No 30.1% Undecided 29.2%

7. Did the study of construction help you to decide what you might like to do?

   Yes 40.0% No 36.3% Undecided 23.6%

8. Would you be interested in taking more courses in construction technology in junior or senior high school if you had the opportunity?

   Yes 58.9% No 20.2% Undecided 20.8%

9. When you were studying construction, did you usually want to spend more time in class than was allowed by your schedule?

Yes 79.9% No 10.5% Undecided 9.4%

10. Did you enjoy working as a member of a group in the laboratory activities?

Yes 53.9% No 13.7% Undecided 32.3%

11. Would you prefer to work on projects by yourself instead of working in a group?

Yes 51.5% No 32.2% Undecided 16.2%

12. Did you like working under the direction of a student foreman?

Yes 37.6% No 43.3% Undecided 19.0%

13. Did you have a chance to work as a foreman?

Yes, very often 22.7% No 26.5% Never 50.6%

14. Did you find the readings in the textbook interesting?

Yes 35.3% No 37.7% Undecided 26.9%

15. Do you think that home reading assignments in construction are necessary for students to better understand the construction industry?

Yes 43.9% No 28.3% Undecided 27.7%

16. Did you find the production activities in the laboratory exciting?

Yes 71.2% No 10.6% Undecided 18.0%

17. Were you able to adequately perform the laboratory activities in your class?

Yes 70.1% No 15.2% Undecided 14.5%

18. Were the activities and directions outlined in the laboratory manual easy to follow?

Yes 48.7% No 14.5% Undecided 36.7%

19. Would you prefer to have more laboratory activities?

Yes 70.0%   No 16.3%   Undecided 13.5%

20. Generally speaking, do you think that the study of construction as presented in your class was easy for you to understand?

Yes 62.5%   No 12.3%   Undecided 25.1%

21. Which semester was the more interesting?

First 13.3%   Second 63.3%   No difference 23.3%

22. Would you like to make more projects that you could take home?

Yes 81.0%   No 11.3%   Undecided 7.5%

23. Do you feel that there was enough materials, tools, and equipment available to adequately perform laboratory activities?

Yes 64.3%   No 35.6%

24. Do you think enough laboratory space was available to adequately perform construction activities?

Yes 73.9%   No 26.0%

25. Indicate your feelings about the amount of time allowed for adequately completing laboratory activities.

Too much 3.7%   Just right 34.8%   Not enough 61.4%

THE WORLD OF MANUFACTURING

Student Questionnaire Summary

1. Did you enjoy studying manufacturing?

Yes 78.4%   No 9.2%   Undecided 11.8%

2. Would you recommend this course to your friends?

Yes 76.0%   No 12.0%   Undecided 12.0%

3. Do you think that seventh grade boys in all junior high schools should have a chance to study manufacturing?

Yes 68.0% No 23.0% Undecided 9.0%

4. Do you feel that you now have a good general understanding of many phases of manufacturing?

Yes 76.8% No 12.6% Undecided 10.5%

5. Do you feel that the experience you have had and the information you have gained in studying manufacturing will be of value to you later in life?

Yes 62.6% No 13.9% Undecided 23.4%

6. Do you think you might like to work in some phase of manufacturing as an adult?

Yes 34.5% No 35.1% Undecided 30.3%

7. Did the study of manufacturing help you to decide what you might like to do?

Yes 29.7% No 46.5% Undecided 23.7%

8. Would you be interested in taking more courses in manufacturing technology in junior or senior high school if you had the opportunity?

Yes 44.1% No 32.8% Undecided 22.9%

9. When you were studying manufacturing, did you usually want to spend more time in class than was allowed by your schedule?

Yes 67.8% No 20.6% Undecided 11.5%

10. Did you enjoy working as a member of a group in the laboratory activities?

Yes 72.2% No 16.5% Undecided 10.6%

11. Would you prefer to work on projects by yourself instead of working in a group?

Yes 49.4% No 35.2% Undecided 15.2%

12. Did you like working under the direction of a student foreman?

Yes 34.4% No 47.3% Undecided 18.2%

13. Did you have a chance to work as a foreman?

Yes, very often 22.2% Sometimes 30.8% Never 46.8%

14. Did you find the readings in the textbook interesting?

Yes 25.4% No 48.9% Undecided 25.6%

15. Do you think that home reading assignments in manufacturing are necessary for students to better understand the manufacturing industry?

Yes 32.5% No 40.3% Sometimes 27.0%

16. Did you find the production activities in the laboratory exciting?

Yes 65.3% No 13.2% Undecided 21.3%

17. Were you able to adequately perform the laboratory activities in your class?

Yes 80.5% No 11.6% Undecided 7.7%

18. Were the activities and directions outlined in the laboratory manual easy to follow?

Yes 64.5% No 16.2% Undecided 19.1%

19. Would you prefer to have more laboratory activities?

Yes 82.1% No 11.8% Undecided 6.0%

20. Generally speaking, do you think that the study of manufacturing as presented in your class was easy for you to understand?

Yes 64.0% No 15.6% Undecided 20.2%

21. Which semester was the more interesting?

First 7.7% Second 65.8% No difference 26.4%

22. Would you like to make more projects that you could take home?

Yes 84.6% No 10.5% Undecided 4.7%

23. Do you feel that there was enough materials, tools, and equipment available to adequately perform laboratory activities?

Yes 67.6% No 32.3%

24. Do you think enough laboratory space was available to adequately perform manufacturing activities?

Yes 85.4% No 14.5%

25. Indicate your feelings about the amount of time allowed for adequately completing laboratory activities.

Too much 4.7% Just right 32.3% Not enough 62.8%

APPENDIX G

Parents' Responses in Percentage Figures on the Construction and Manufacturing Parent Questionnaires

THE WORLD OF CONSTRUCTION

Parents' Questionnaire Summary

1. My child's study of "The World of Construction" has been an asset to his education.

   Yes 90.5% No 3.9% Undecided 5.4%

2. My child frequently made favorable comments about his construction class.

   Yes 90.9% No 5.4% Undecided 3.5%

3. My child has frequently expressed a dislike for his construction class.

   Yes 8.2% No 89.7% Undecided 1.9%

4. My child has benefited more from his study of construction than he probably would have in the traditional industrial arts course (wood-shop, metalshop, & mechanical drawing) typically offered in junior high schools.

   Yes 62.4% No 12.7% Undecided 24.8%

5. A broad and thorough understanding of modern industry cannot be adequately taught in the traditional industrial arts program of woodworking, metals, and drafting.

   Yes 50.0% No 16.8% Undecided 33.1%

6. I would have preferred my child to have an industrial arts program concentrating primarily on the development of skill in the use of woodworking machines and hand tools rather than a broad coverage of the construction industry.

   Yes 13.0% No 71.9% Undecided 15.0%

7. The study of construction has given my child an opportunity to learn about possible occupational or career interests.

   Yes 82.6% No 6.1% Undecided 11.1%

8. My child has expressed an interest in a particular career or occupation as a result of having been informed about it in the study of construction.

Yes 25.5% No 54.7% Undecided 19.6%

9. It is a responsibility of industrial arts instruction to help students identify their career or occupational interests.

Yes 47.2% No 30.1% Undecided 22.6%

10. Are you disappointed that the study of construction did not require making numerous take-home objects?

Yes 14.1% No 79.9% Undecided 5.9%

11. Industrial arts instruction should restrict itself primarily to hobby and handicraft activity.

Yes 9.1% No 84.9% Undecided 5.9%

12. Do you believe that the study of construction techniques and practices used by architects, engineers, city planners, craftsmen, homeowners, etc., is an important area of study for youth?

Yes 96.0% No 0.3% Undecided 3.5%

13. It is important for my child to know something about home construction (planning, designing, building, repairing, etc.).

Yes 97.2% No 1.5% Undecided 1.1%

14. It is necessary for my child to know something about acquiring a home (financing, purchasing property, contracting, etc.).

Yes 94.0% No 2.8% Undecided 3.1%

15. By studying and being involved in industrial arts activities, my child will have a better opportunity to identify the career or occupation in which he might like to work.

Yes 86.3% No 5.8% Undecided 7.8%

16. It is important for my child to be informed about labor unions, hiring practices, contracts, striking, negotiating, etc.

Yes 88.5% No 5.3% Undecided 6.1%

17. It is important for my child to learn about both management and production personnel and also, employee-employer relations.

Yes 91.3% No 3.9% Undecided 4.7%

18. Even if my child decides to work in a profession not directly related to industry, he would benefit from his study of construction.

Yes 94.0% No 2.3% Undecided 3.5%

19. I can see where I would have profited from the construction course when I was in the 7th and 8th grades.

Yes 81.3% No 9.5% Undecided 9.1%

20. I have looked at "The World of Construction" books which my child uses in industrial arts.

Yes 74.9% No 25.0%

21. If your response to question 20 was "Yes", please respond to statements A to D regarding the books.

A. I found the instructional materials interesting.

Yes 93.9% No 2.6% Undecided 3.5%

B. I feel that they are written at a level which is appropriate for junior high school age children.

Yes 89.2% No 4.9% Undecided 5.8%

C. The information in the books appears to be in agreement with modern industrial practices.

Yes 89.3% No 0.5% Undecided 10.1%

D. The books reflect the type of learning I would like my child to receive from industrial arts.

Yes 90.8% No 2.1% Undecided 7.0%

22. Did you visit your son's construction course during open house, or at any other time during the school year?

Yes 61.6%   No 38.3%

If you did, what was your general reaction?

favorably impressed 94.3%

unfavorably impressed 0.6%

neutral 5.0%

THE WORLD OF MANUFACTURING

Parent Questionnaire Summary

1. My child's study of "The World of Manufacturing" has been an asset to his education.

Yes 80.9%   No 9.5%   Undecided 9.5%

2. My child frequently made favorable comments about his manufacturing class.

Yes 81.1%   No 13.9%   Undecided 4.8%

3. My child frequently expressed a dislike for his manufacturing class.

Yes 11.5%   No 81.4%   Undecided 6.9%

4. My child has benefited more from his study of manufacturing than he probably would have in the traditional industrial arts course (woodshop, metalshop, & mechanical drawing) typically offered in junior high schools.

Yes 55.3%   No 13.2%   Undecided 31.4%

5. A broad and thorough understanding of modern industry cannot be adequately taught in the traditional industrial arts program of woodworking, metals, and drafting.

Yes 44.6%   No 21.6%   Undecided 33.6%

6. I would have preferred my child to have an industrial arts program concentrating primarily on the development of skill in the use of metalworking machines and hand tools rather than a broad coverage of the manufacturing industry.

Yes 20.9% No 60.8% Undecided 18.1%

7. The study of manufacturing has given my child an opportunity to learn about possible occupational or career interests.

Yes 80.1% No 10.6% Undecided 9.2%

8. My child has expressed an interest in a particular career or occupation as a result of having been informed about it in the study of manufacturing.

Yes 23.8% No 55.3% Undecided 20.9%

9. It is a responsibility of industrial arts instruction to help students identify their career or occupational interests.

Yes 51.7% No 28.9% Undecided 19.2%

10. Are you disappointed that the study of manufacturing did not require making numerous take-home projects?

Yes 16.0% No 79.2% Undecided 4.8%

11. Industrial arts instruction should restrict itself primarily to hobby and handicraft activities.

Yes 12.0% No 76.6% Undecided 11.3%

12. Do you believe that the study of manufacturing techniques and practices used by designers, engineers, tradesmen, production workers, etc., is an important area of study for youth?

Yes 90.1% No 3.5% Undecided 6.3%

13. It is important for my child to know something about the production of consumer products (planning, designing, producing, repairing, servicing, etc.).

Yes 91.8% No 3.5% Undecided 4.5%

14. It is necessary for my child to know something about purchasing products (financing, quality, workmanship, etc.).

Yes 93.3% No 4.5% Undecided 2.1%

15. By studying and being involved in industrial arts activities, my child will have a better opportunity to identify the career or occupation in which he might like to work.

Yes 81.3% No 7.0% Undecided 11.6%

16. It is important for my child to be informed about labor unions, hiring practices, contracts, striking, negotiating, etc.

Yes 92.0% No 6.3% Undecided 1.7%

17. It is important for my child to learn about both management and production personnel and also, employee-employer relations.

Yes 91.8% No 6.3% Undecided 1.7%

18. Even if my child decides to work in a profession not directly related to industry, he would benefit from his study of manufacturing.

Yes 89.7% No 2.4% Undecided 7.8%

19. I can see where I would have profited from the manufacturing course when I was in the 7th and 8th grades.

Yes 73.1% No 10.6% Undecided 16.2%

20. I have looked at "The World of Manufacturing" books which my child uses in industrial arts.

Yes 63.3% No 35.5% Undecided 1.0%

21. If your response to Question 20 is "yes", please respond to statements A to D regarding the books.

A. I found the instructional materials interesting.

Yes 92.7% No 4.1% Undecided 3.1%

B. I feel that they are written at a level which is appropriate for junior high school age children.

Yes 85.8% No 8.5% Undecided 5.5%

C. The information in the books appears to be in agreement with modern industrial practices.

Yes 89.0% No 1.5% Undecided 9.4%

D. The books reflect the type of learning I would like my child to receive from industrial arts.

Yes 86.2% No 5.2% Undecided 8.4%

22. Did you visit your son's manufacturing course during open house, or at any other time during the school year?

Yes 55.2% No 44.7%

If you did, what was your general reaction?

favorably impressed 92.8%

unfavorably impressed 1.9%

neutral 5.2%

APPENDIX H

Administrators' Responses in Percentage Figures on the Construction and Manufacturing Administrator Questionnaires

THE WORLD OF CONSTRUCTION

Administrators' Questionnaire Summary
1970

1. Do you think that the overall program of the study of construction is appropriate for junior high school students to understand?

   Yes 100% No 0%

2. Do you feel that the study of construction gives students a more comprehensive understanding of the "world of work" than they would obtain from a traditional junior high program of woods, metals, and drawing?

   Yes 100% No 0%

3. Do you feel that a student who studies construction has a better understanding of a variety of career or occupational opportunities than a student who completes a traditional woodworking course?

   Yes 100% No 0%

4. Do you feel that students who complete the study of construction have a good basic knowledge of the use of hand and power tools?

   Yes 100% No 0%

5. Do you feel that construction students have a better understanding of the materials and practices used in construction technology than students who study traditional industrial arts?

   Yes 73.3% No 26.7%

6. What have you observed about student enthusiasm regarding the construction course?

   Highly favorable 86.6% Favorable 13.4% Not very favorable 0%

7. What type of comments have you heard from parents concerning the study of construction?

   Highly favorable 86.6% Favorable 13.4% Not very favorable 0%

8. Does the study of construction present as accurate a picture of construction as is possible in a school setting?

Yes 100% No 0%

9. Have parents and other visitors come to your school to observe the construction classes?

Yes 100% No 0%

10. If yes to item 9, how has the quantity of visitation compared with visitations to other instructional programs in the school?

More 93.4% Less 0% Don't know 6.6%

11. If yes to item 10, what has been their reaction to the program?

Very favorable 73.3% Favorable 26.7% Unfavorable 0%

12. Do you think that <u>all</u> junior high students would benefit from studying construction?

Yes 93.4% No 6.6%

13. Have you noticed changes in your industrial arts teachers' attitudes and/or performance since the study of construction was introduced in the school?

Positive 93.4% Negative 0% No change 6.6%

14. Has the construction course brought about a response from other teachers in your school?

Intense interest 53.3% Mild interest 46.7% No interest 0%

15. The content in the construction course is more structured than most traditional industrial arts courses to insure that course objectives may be met. What is your impression of this method as compared with methods used in traditional industrial arts courses?

Strongly approve 73.3% Approve 26.7% Don't approve 0%

16. Has there been any particular problem in placing slow learners in the construction course?

Yes 13.4% No 86.6%

17. How have slow learners succeeded in the construction course as compared to those taking traditional industrial arts?

Better 46.0% Just as well 23.0% Poorer 8.0% Don't know 23.0%

18. Has there been any indication of transfer of subject matter from the construction course to other subject areas?

Yes 100% No 0%

19. Did the construction course cost more per student to operate than the traditional industrial arts course?

Yes 75.0% No 25.0%

20. If you were to construct new industrial arts facilities, do you think that the initial cost of equipping the construction laboratory would be more than the cost of equipping a traditional woodworking laboratory?

The construction laboratory would cost more 7.8%
The construction laboratory would cost about the same 53.8%
The construction laboratory would cost less 38.4%

21. After the construction laboratory is fully equipped, do you think it will cost more to maintain?

Yes 28.6% No 50.0% About the same 21.4%

22. If your responses to questions 19, 20, or 21 are "yes", do you feel that the new program is worth a higher budget?

Yes 100% No 0%

23. Are your students charged for the materials they use in the traditional industrial arts courses?

Yes 78.6% No 21.4%

24. Are your students charged for materials used in the study of construction?

Yes 33.3% No 66.6%

25. Did you have any particular custodial problems with the construction laboratory?

Yes 28.6% No 71.4%

26. Did the required time for the construction course differ from the time allotted for industrial arts courses in the past?

Greater 46.2% Less 0% Same 53.8%

27. If greater, how did this affect the total program scheduling in your school?

Not summarized for this report.

28. Have you had any overall program scheduling problems as a result of the IACP program in your school?

Yes 28.6% No 71.4%

29. If you did have particular problems, how did you solve these problems?

Not summarized for this report.

30. Did you have difficulty in placing transfer students in the construction course during the school year?

Yes 0% No 100%

31. Did you offer traditional industrial arts courses during the same time as the construction course?

Yes 42.9% No 57.1%

32. If yes, what percentage elected to take the traditional course? What percentage elected to take the construction course?

Inadequate response.

33. Did you have students who wanted to take the construction course but could not get into the course for some reason?

Yes 35.7% No 64.3%

34. What is the maximum number of students that were allowed to enroll in each construction course?

28

35. If you limited the enrollment, did this cause a hardship regarding other industrial arts teachers' load?

Yes 7.7% No 92.3%

36. Please estimate the percentage of students electing to enroll in the manufacturing course after taking the construction course.

70-100% 81.1% 40-70% 54.8% Below 40% 18.1% Don't know 9.0%

37. How does your response to item 36 compare with students electing to enroll in traditional industrial arts elective courses after completing traditional industrial arts requirements in years before IACP courses were used in your school?

Greatly 12.5% Same 62.5% Less 12.5% Don't know 12.5%

38. Do you feel that the problem of discipline has been influenced as a result of students studying construction, as compared with traditional industrial arts courses?

Reduced 33.3% Increased 0% No change 66.6%

39. What is your opinion about the quantity of reading required of students in the study of construction?

There is Not enough 0% Adequate amount 57.1% Too much 42.9%

40. Do you intend to continue offering the study of construction in your school after the experimental phase has ended?

Yes 100% No 0%

THE WORLD OF MANUFACTURING

Administrators' Questionnaire Summary
1971

1. Do you think that the overall program of the study of manufacturing is appropriate for junior high school students to understand?

   Yes 100% No 0%

2. Do you feel that the study of manufacturing gives students more comprehensive understanding of the "world of work" than they would have received from a traditional junior high program of woods, metals, and drawing?

   Yes 100% No 0%

3. Do you feel that a student who studies manufacturing has a better understanding of a variety of career or occupational opportunities than a student who completes a traditional woodworking course?

   Yes 100% No 0%

4. Do you feel that students who complete the study of manufacturing have a good basic knowledge of the use of hand and power tools?

   Yes 76% No 24%

5. Do you feel that manufacturing students have a better understanding of the materials and practices used in manufacturing technology than students who study traditional industrial arts?

   Yes 100% No 0%

6. What have you observed about student enthusiasm regarding the manufacturing course?

   Highly favorable 81% Favorable 19% Not very favorable 0%

7. What type of comments have you heard from parents concerning the study of manufacturing?

   Highly favorable 43% Favorable 52% Negative ___ No Comment 1

8. Does the study of manufacturing present as accurate a picture of manufacturing technology as is possible in a school setting?

Yes 81% No 14% No Comment 1

9. Have parents and other visitors come to your school to observe the manufacturing classes?

Yes 95% No 4%

10. If yes to item 9, how has the quantity of visitation compared with visitations to other instructional programs in the school?

More 76% Less 5% Don't know 5% No Response 3

11. If yes to item 10, what has been their reaction to the program?

Very favorable 52% Favorable 38% Unfavorable ___ No Response 3

12. Do you think that all junior high students would benefit from studying manufacturing?

Yes 71% No 29%

13. Have you noticed changes in your industrial arts teachers' attitudes and/or performance since the study of manufacturing was introduced in the school?

Positive 95% Negative 4% No Change 4

14. Has the manufacturing course brought about a response from other teachers in your school?

Intense interest 24% Mild interest 71% No interest 0% No Response 1

15. The content in the manufacturing course is more structured than most traditional industrial arts courses to insure that course objectives may be met. What is your impression of this method as compared with methods used in traditional industrial arts courses?

Strongly approve 67% Approve 33% Don't approve 0%

16. Has there been any particular problem in placing slow learners in the manufacturing course?

Yes 43% No 57%

17. How have slow learners succeeded in the manufacturing course as compared to those taking traditional industrial arts?

Better 14% Just as well 48% Poorer 20% Don't know 4% No Response 1

18. Has there been any indication of transfer of subject matter from the manufacturing course to other subject areas?

Yes 31% No 10% No Response 5

19. Did the manufacturing course cost more per student to operate than the traditional industrial arts course?

Yes 48% No 33% Don't know 1 No Response 3

20. If you were to construct new industrial arts facilities, do you think that the initial cost of equipping the manufacturing laboratory would be more than the cost of equipping a traditional woodworking laboratory?

The manufacturing laboratory would cost more 24%
The manufacturing laboratory would cost about the same 29%
The manufacturing laboratory would cost less 38%
No Response 3

21. After the manufacturing laboratory is fully equipped, do you think it will cost more to maintain?

Yes 4% No 62% About the same 29% No Response 1

22. If your responses to questions 19, 20, or 21 are "yes" do you feel that the new program is worth a higher budget?

Yes 62% No 4% No Response 7

23. Are your students charged for the materials they use in the traditional industrial arts courses ?

Yes 48% No 48% No Response 1

24. Are your students charged for materials used in the study of manufacturing ?

Yes 33% No 48% No Response 4

25. Did you have any particular custodial problems with the manufacturing laboratory?

Yes 4% No 90% No Response 1

26. Did the required time for the manufacturing course differ from the time allotted for industrial arts courses in the past?

Greater 33% Less 0% Same 62% No Response 1

27. If greater, how did this affect the total program scheduling in your school? (Not summarized here.)

28. Have you had any overall program scheduling problems as a result of the IACP program in your school?

Yes 33% No 62% No Response 1

29. If you did have particular problems, how did you solve these problems? (Not summarized here.)

30. Did you have difficulty in placing transfer students in the manufacturing course during the school year?

Yes 0% No 95% No Response 1

31. Did you offer traditional industrial arts courses during the same time as the manufacturing course?

Yes 48% No 48% No Response 1

32. If yes, what percentage elected to take the traditional course? What percentage elected to take the manufacturing course?
(Inadequate Response)

33. Did you have students who wanted to take the manufacturing course but could not get into the course for some reason?

Yes 33% No 57%

34. What is the maximum number of students that were allowed to enroll in each manufacturing class? average - 28

35. If you limited the enrollment, did this cause a hardship regarding other industrial arts teachers' load?

Yes 4% No 76% No Response 4

36. Have enrollment figures changed in the selection of industrial arts elective courses in the upper grades since IACP courses have been taught in your school?

Greatly 14% Same 0% Less 0% Don't know 29% No Response 10

37. Do you feel that the problem of discipline has been influenced as a result of students studying manufacturing, as compared with traditional industrial arts courses?

Reduced 67% Increased 4% No Change 19% No Response 2

38. What is your opinion about the quantity of reading required of students in the study of manufacturing?

There is not enough 4% Adequate 57% Too much 38%

39. Do you intend to continue offering the study of manufacturing in your school after the experimental phase has ended?

Yes 95% No 0% No Response 1

40. If you so desire, please comment on the impact that you believe that manufacturing had on the total school program. (Use additional paper if necessary.)

APPENDIX I

Responses of Principals to Interviews
Conducted by Field Evaluation Center Directors

PRINCIPALS' INTERVIEW RESPONSES

The following comments are a summation of the comments made by 23 principals. The data were collected by the six Field Evaluation Center directors who personally interviewed principals in each of the IACP schools. All comments were studied, and a composite statement was developed to reflect the most frequent and pressing responses to the following questions:

A. What, if any, additional scheduling problems has the IACP program caused in your school?

   1. Holding class size to the desired number of 25 pupils per class when teacher allotment is based on 30 pupils per class.

   2. Scheduling a matching program for girls in home economics so co-educational programs can be scheduled in academic classrooms.

   3. IACP program helps in scheduling because industrial arts classes do not have to be set up to rotate through exploratory areas such as woods, plastics, metals, electricity, graphic arts, and drafting.

   4. Reduces flexibility of scheduling with classes that meet two or three periods a week such as: Art, Music, Reading Improvement, etc.

   5. Fourteen principals either reported no problems, or commented on how implementing the program has impaired scheduling.

B. What, if any, new problems or conflicts (custodial, disciplinary, etc.) in the operation of the school occurred as the result of the inclusion of the IACP program in the curriculum?

   1. Four principals made a direct comment confirming fewer disciplinary problems. Fourteen principals said there were either no disciplinary problems or that the implementation of the program has actually contributed to the reduction of these problems.

   2. Other problems identified by other principals were:

a) Dust and tracking caused by the activities that used cement, clay, and plastic.
b) Storage of materials and disposing of consumable materials.
c) Reading problems when lower-ability students are involved.

C. What, if any, opinions have community organizations, parents, or other individuals expressed about the IACP program?

1. Eighteen principals reported favorable to highly favorable reactions from parents, community, and students. These comments were based on contacts made through P.T.A. meetings, open-house programs, and with P.T.A. groups working in the community publicizing the program.

2. Two principals had no comments, since they had not solicited any reactions. Other recorded comments dealt with the difficulty and the amount of reading involved at the beginning of the course.

D. In your opinion, what are the strongest features or characteristics of the IACP program at this time? The weakest features? In summarizing the comments made in regard to the strengths and weaknesses of the program, the following list is in order of frequency as they were mentioned in the dialogue.

1. Strengths:
   a) The comprehensiveness of the program.
   b) Relevance of the program to today's technology.
   c) The occupational orientation involvement for the student.
   d) The program improves students' interest in school and provides motivation for school activities.
   e) The high interest the teachers have in teaching the program
   f) The students learn more and acquire more relevant information than they have in the past.

2. Weaknesses:
   a) Too difficult and too much reading.
   b) More activity needed in somre areas.
   c) Too much teacher preparation time.
   d) Too tight a schedule to complete the course.
   e) The vocabulary and background knowledge needed are too much for students to grasp.

f) The course is too structured.

E. How does the cost of operating the IACP program compare with the cost of operating past IA programs? If the operating cost of IACP is more, how is this cost being met?

1. Twelve principals reported that, although the cost is higher at the beginning, there is little difference after the initial cost.

2. Nine principals reported that extra help in the form of money or material was necessary to initiate the program. The source for these materials came from the following areas:
   a) The $400 from The Ohio State University Research Foundation.
   b) The central office account supplemented the individual school's accounts.
   c) Materials from such organizations as the Associated General Contractors.

3. Several principals reported that, even though the cost may be higher, the quality of education provided was worth it and that the cost presented no problem.

F. How adequately do you believe the IACP program meets the needs of all the students in your school?

1. Twenty-two principals reported that the course does meet the needs of the students extremely well, involving them in exploring all phases of industry to a much greater degree than does the conventional program.

2. Accompanying the above statement, other comments were added as suggestions for improvement. Concern was expressed for those students who are at the lower third of the class in ability to learn.
   a) The course needs less theory and more work with hands.
   b) Reading level presents a problem for the low-ability student.

G. What indications of interest or disinterest have you received from your students?

1. Principals reported that, either interest is high for the most part, or they have not received any indications of disinter-

est. Some reference was made to disinterest in "The World of Manufacturing," 1st edition, but this was corrected by more meaningful laboratory activities in later revisions.

2. Three principals reported comments about dissatisfaction on the part of some students concerning the amount of reading in the first edition; less dissatisfaction with the later editions.

H. Has there been an indication of carry-over of subject matter from the IACP program to other subject areas?

1. Approximately half of the principals reported known instances where carry-over of IACP subject matter was being referred to by students in other classes. Some schools reported that the staff had made an organized effort to use the carry-over to reinforce the subject matter of mathematics, English, social studies, and science.

2. The other principals reported that they had made no organized investigation, and so did not know if carry-over was taking place.

3. One center reports specifically that in their work-study class, discussion often focuses on construction and manufacturing. Teachers of these classes have asked for IACP materials. In speech classes, the boys often give a speech on some topic covered in IACP.

I. What indications of interest have you received from teachers (other than IA) in your school? Construction and manufacturing teachers? Other IA teachers?

1. Twenty-two principals reported that IACP teachers are really enthusiastic about the program, that they wish to continue it, and that they have not received any negative comments if other industrial arts teachers have been in the building.

2. There were varied comments about the interest indicated by other members of the teaching staff. In most of the schools the programs had been explained to the staff, and the principal offered the following kinds of comments.
   a) Other teachers asked to take the IACP classes when the regular teacher was absent.
   b) Impressed with its organization and text materials.

c) Teaching staff has a high opinion of the IACP teacher and respect for him.
d) The teacher's guide receives many favorable comments.
e) Teachers stop by the IACP shop to watch the activities.
f) A general increase in interest towards industrial arts by teachers, parents, and students.

J. In what ways, if any, has your understanding of industrial arts changed since you became involved with the IACP?

1. The principals reported that they have supported industrial arts in the past and have always thought that it should be more than teaching a student to build an item of his choice. Moreover, they felt that teaching the concepts of industry, as set forth in the IACP rationale, is an innovation long overdue.

2. Several comments were made to emphasize their opinion:
   a) "It leads to study of industry, not just making things."
   b) "My interest in industrial arts has increased."
   c) "Industrial arts now has content that has worth."
   d) "IACP programs have opened my eyes to the tremendous contribution that industrial arts education can make to most youngsters."

K. Please make a brief statement which summarizes your feelings about the IACP programs at this time.

1. The best way to summarize the comments by the principals is to quote a statement made by a principal from Austin, Texas:

   > "Best thing to happen to industrial arts in my 20 years of association in education. Good introduction to the world of work --- not just labor, or skilled employment, or management, but the total world of work --- "world of work" being defined as any way that a man earns a living."

2. All comments were positive and expressed a concern for further development and implementation of the rationale in the high school.

APPENDIX J

Teaching and Supervisory Personnel
Responses to Construction and Manufacturing
Software Questionnaires

Exhibit 1 - Construction Software Questionnaire

Exhibit 2 - Manufacturing Software Questionnaire

Exhibit 3 - Accomplishment of Objectives for Construction and Manufacturing

Exhibit 1

Construction Software Questionnaire

CONSTRUCTION QUESTIONNAIRE

Name ______________________ Date ______________________

Evaluation or
Demonstration Center ______________________________________

School ____

Directions: Read each statement carefully and circle one of the responses which appear below the statement. The following response code is used:

SA - Strongly agree with the statement
A - Agree with the statement
U - Undecided about the statement
D - Disagree with the statement
SD - Strongly disagree with the statement

Feel free to expand or clarify your opinions about any statements in this questionnaire by making notations underneath the particular statement.

LABORATORY MANUAL

1. Illustrations and photographs used in the construction laboratory manual help students to understand and perform the activities.

   SA 48% A 48% U 3% D 0% SD 0%

2. Illustrations and photographs used in the construction laboratory manual are attractive and of professional quality.

   SA 27% A 51% U 15% D 6% SD 0%

3. The organization and sequence of the laboratory manual which consists of an introduction, problem statement, objectives, procedure, and questions aids students in performing the activities.

   SA 21% A 66% U 6% D 3% SD 0% NR 3%

4. Activities in the laboratory manual help students understand concepts of construction technology.

   SA 42% A 57% U 0% D 0% SD 0%

5. Activities in the construction laboratory manual are directly related to construction technology concepts covered in the textbook readings.

SA 39% A 57% U 0% D 3% SD 0%

6. To have a good understanding of construction technology, it is necessary for students to apply concepts in the laboratory by performing various construction practices and techniques.

SA 63% A 33% U 3% D 0% SD 0%

7. Role-playing appears to be an effective method of teaching students about certain construction practices, such as resolving management-labor disputes.

SA 48% A 39% U 12% D 0% SD 0%

8. Students generally participate eagerly in role-playing situations.

SA 30% A 42% U 18% D 9% SD 0%

9. Participation in the design and construction of the house module provides students with an opportunity to develop a variety of technical performance skills.

SA 30% A 33% U 18% D 18% SD 0%

10. Students are interested and enjoy the activities dealing with production practices such as the construction of the house module.

SA 60% A 36% U 0% D 0% SD 0% NR 3%

11. Students are interested and enjoy the activities that deal with management practices, such as playing Big Builder or preparing specifications for a construction project.

SA 0% A 45% U 27% D 24% SD 0% NR 3%

12. Students are interested and enjoy participating in lab activities dealing with personnel practices such as hiring, training, advancing, firing, and retiring.

SA 21% A 45% U 12% D 18% SD 0% NR 3%

13. Students are generally not disappointed over the lack of "take-home projects" in the construction course.

SA 18% A 48% U 18% D 15% SD 3% NR 6%

14. Planning, designing, and construction of the dream house is adequately organized and presented in the laboratory manual.

SA 39% A 42% U 6% D 3% SD 0% NR 9%

15. Students generally read, understand, and follow the procedures listed in the laboratory manual.

SA 9% A 30% U 21% D 24% SD 3% NR 12%

16. Students reading between the 7th and 8th grade levels can understand the information in the laboratory manual.

SA 12% A 63% U 12% D 9% SD 0% NR 3%

17. Performing the activities under "City and Regional Planning" provides students with a more thorough understanding of construction technology.

SA 12% A 48% U 21% D 12% SD 0% NR 6%

18. Students are interested in participating in the city and regional planning activities.

SA 9% A 33% U 45% D 3% SD 0% NR 9%

19. Adequate proportions of group activities and individual activities have been utilized in the laboratory manual.

SA 6% A 69% U 15% D 6% SD 3%

20. A good way of imitating construction practices in the school is to have students work together as members of a construction gang.

SA 36% A 63% U 0% D 0% SD 0%

21. Students usually complete the charts and questions which are found in various units of the laboratory manual.

SA 6% A 57% U 18% D 15% SD 3%

22. Students who complete the charts and questions in the laboratory manual generally learn more about construction technology than those who do not complete the charts and questions.

SA 27% A 42% U 27% D 3% SD 0%

23. Time allotment for completion of laboratory activities is generally satisfactory.

SA 9% A 63% U 15% D 9% SD 0% NR 3%

24. Overall, the laboratory manual is well designed to withstand daily use by the student during his study of construction.

SA 15% A 57% U 12% D 9% SD 3% NR 3%

25. Generally, the simulated activities in the construction course are effective and realistic methods for students to experience construction practices.

SA 36% A 60% U 3% D 0% SD 0%

TEACHER'S GUIDE

26. The Teacher's Guide is designed and organized to help the teacher perform efficiently and effectively.

SA 57% A 39% U 3% D 0% SD 0%

27. Behavioral objectives listed for the assignments in the Teacher's Guide are clearly stated, understandable, and obtainable.

SA 33% A 54% U 6% D 6% SD 0%

28. Directions for organizing and conducting laboratory activities can be easily understood by the IACP teacher.

SA 39% A 60% U 0% D 0% SD 0%

29. The loose leaf binder is a satisfactory method for binding the Teacher's Guide.

SA 48% A 48% U 3% D 0% SD 3%

30. The type face and size used in the Teacher's Guide facilitates the reading of the material.

SA 48% A 48% U 3% D 0% SD 0%

31. After completing the daily assignments, students can generally satisfy the objectives listed for the text.

SA 6% A 60% U 27% D 6% SD 0%

32. After completing the daily assignments, students can generally satisfy the objectives listed for the discussion.

SA 6% A 63% U 27% D 3% SD 0%

33. After completing the daily assignments, students can generally satisfy the objectives listed for the laboratory activities.

SA 15% A 66% U 15% D 3% SD 0%

34. Equipment and supply lists in the Teacher's Guide are accurate, comprehensive, and useful.

SA 21% A 66% U 5% D 0% SD 3%

35. Things to be demonstrated by the teacher are adequately explained in the Teacher's Guide.

SA 24% A 72% U 3% D 0% SD 0%

36. Instructions for conducting the City and Regional Planning Activity are satisfactory.

SA 3% A 69% U 15% D 0% SD 0% NR 12%

37. The appendices A, B, and C located at the end of the Teacher's Guide are accurate, useful, and comprehensive.

SA 30% A 45% U 21% D 0% SD 0% NR 3%

38. Safety precautions for laboratory activities are adequately covered in the Teacher's Guide.

SA 15% A 75% U 3% D 6% SD 0%

39. Periodic review periods prior to tests help students further understand concepts learned in previous lessons.

SA 27% A 57% U 6% D 3% SD 3% NR 3%

40. The number of textbook readings assigned for homework per week is realistic.

SA 18% A 45% U 18% D 15% SD 3%

41. Information in the discussion and lecture sections of the Teacher's Guide is written so that it can be easily presented to students.

SA 33% A 57% U 9% D 0% SD 0%

42. The table of contents used in the construction Teacher's Guide is accurate, comprehensive, and useful.

SA 27% A 63% U 9% D 0% SD 0%

43. The filmstrip entitled "Introduction to The World of Construction" provides the student with an interesting overview of the construction course.

SA 36% A 42% U 6% D 6% SD 0% NR 9%

44. Filmstrips show up-to-date practices of construction technology.

SA 12% A 60% U 15% D 6% SD 0% NR 6%

45. Generally students are interested in viewing the filmstrips which deal with construction technology.

SA 24% A 60% U 9% D 0% SD 0% NR 6%

46. Filmstrip scripts are accurate, concise, and descriptive.

SA 6% A 60% U 18% D 6% SD 0%

47. Overhead transparencies used in the construction course are helpful in teaching about construction technology.

SA 42% A 51% U 0% D 0% SD 0% NR 6%

48. On an overall basis, "hardware" used in the construction course is functional.

SA 21% A 72% U 3% D 0% SD 0% NR 3%

49. "Hardware" used in the construction course can withstand continuous student usage.

SA 3% A 78% U 9% D 6% SD 0% NR 3%

50. Achievement test results provide teachers with useful information relative to student performance that may be used to improve the teaching-learning process.

SA 15% A 63% U 9% D 9% SD 0% NR 3%

51. Construction achievement tests provide one valid measure concerning how well the student has learned about construction technology.

SA 15% A 60% U 9% D 6% SD 6% NR 3%

52. The results of achievement tests should be used primarily to evaluate (assign a course letter grade) students.

SA 6% A 24% U 18% D 33% SD 18%

53. Achievement test results along with other teacher assessments of student performance, can provide the teacher with useful information when formulating course grades.

SA 36% A 57% U 6% D 0% SD 0%

54. There is an adequate number of achievement tests given during the construction course.

SA 24% A 63% U 3% D 6% SD 0% NR 3%

TEXTBOOK

55. The textbook presents an accurate and complete story of "The World of Construction" for junior high school students.

SA 36% A 57% U 6% D 0% SD 0%

56. The subject matter in the readings appear to be appropriate for the maturation level of junior high school age students.

SA 9% A 63% U 18% D 9% SD 0%

57. The major practices used in present-day construction have been included in the textbook readings.

SA 30% A 66% U 3% D 0% SD 0%

58. The organization of the text readings which includes an introduction, body of information, summary, terms to know, and review questions, appears to be a good design for improving student achievement.

SA 12% A 63% U 0% D 0% SD 0% NR 6%

59. The readings can be readily understood by students with a reading ability between the 7th and 9th grade levels.

SA 12% A 63% U 15% D 9% SD 0%

60. Frequent use of illustrations and photographs in the text aid students in understanding the concepts which are covered in the readings.

SA 45% A 54% U 0% D 0% SD 0%

61. Junior high school age students who are reading below the 7th grade level can readily understand the text readings.

SA 0% A 6% U 36% D 36% SD 18% NR 3%

62. Teaching-learning aids such as cognitive maps, "Terms to Know" and "Think About It" questions are utilized by the student.

SA 6% A 39% U 39% D 15% SD 0%

63. Cognitive maps located at the end of each reading, help students to conceptualize and synthesize what they have read.

SA 6% A 54% U 33% D 6% SD 0%

64. The "Terms to Know" section of each reading helps students to better understand the information presented in the readings.

SA 6% A 63% U 27% D 3% SD 0%

65. The "Think About It" questions in the textbook help students to synthesize and apply the concepts covered in the readings.

SA 9% A 63% U 21% D 6% SD 0%

66. The sequence of readings in the textbook appears appropriate.

SA 27% A 66% U 6% D 0% SD 0%

67. The type face and size used in the text body, captions, and headings and subheadings are adequate for junior high school age children.

SA 30% A 66% U 3% D 0% SD 0%

68. Photographs and illustrations used in the text are attractive and of professional quality.

SA 45% A 51% U 0% D 0% SD 0% NR 3%

69. Photographs and illustrations used in the text accurately portray current construction practices.

SA 39% A 60% U 0% D 0% SD 0%

70. Photographs and illustrations in the text help students to better understand construction practices discussed in the textbook.

SA 45% A 54% U 0% D 0% SD 0%

71. Construction practices portrayed in the text are accurate and up-to-date.

SA 33% A 60% U 3% D 3% SD 0%

72. Color is adequately used throughout the text to produce an appealing book.

SA 18% A 60% U 3% D 6% SD 3%

73. To have a good understanding of construction technology, it is necessary for students to read the textbook as well as perform the laboratory activities.

SA 45% A 30% U 21% D 0% SD 0% NR 3%

74. Concepts covered in the textbook readings are reinforced through subsequent laboratory activities.

SA 30% A 66% U 0% D 0% SD 0% NR 3%

75. Students find the text readings interesting and appealing.

SA 0% A 42% U 27% D 18% SD 9% NR 3%

76. The table of contents and index which appear in the text are comprehensive, accurate, and adequate for student and teacher use.

SA 12% A 78% U 6% D 0% SD 0% NR 3%

77. The quality and durability of text binding, paper, and cover stock is adequate for school use.

SA 21% A 66% U 6% D 0% SD 3% NR 3%

Exhibit 2

Manufacturing Software Questionnaire

MANUFACTURING QUESTIONNAIRE

Name ______________________ Date ______________________

Evaluation or
Demonstration Center ______________________________________

School ____

Directions: Read each statement carefully and circle one of the responses which appear below the statement. The following response code is used:

SA = Strongly agree with the statement
A = Agree with the statement
U = Undecided about the statement
D = Disagree with the statement
SD = Strongly disagree with the statement

Feel free to expand or clarify your opinions about any statements in this questionnaire by making notations underneath the particular statement.

MANUFACTURING LABORATORY MANUAL

1. Illustrations and photographs used in the laboratory manual help students to understand and perform the activities.

   SA 35% A 59% U 0% D 3% SD 3%

2. Illustrations and photographs used in the laboratory manual are attractive and of professional quality.

   SA 5% A 42% U 24% D 30% SD 0%

3. The organization and sequence of the laboratory manual which consists of an introduction, problem statement, objectives, procedure, and questions aids students in performing the activities.

   SA 30% A 43% U 19% D 8% SD 0% NR 3%

4. Activities in the laboratory manual help students understand concepts of manufacturing technology.

SA 38% A 49% U 11% D 0% SD 3%

5. Activities in the laboratory manual are directly related to manufacturing technology concepts covered in the textbook readings.

SA 35% A 54% U 8% D 3% SD 9%

6. To have a good understanding of manufacturing technology, it is necessary for students to apply concepts in the laboratory by performing various manufacturing practices and techniques.

SA 62% A 32% U 3% D 3% SD 0%

7. Role-playing appears to be an effective method of teaching students about certain manufacturing practices, such as resolving management-labor disputes.

SA 35% A 35% U 22% D 5% SD 0%

8. Students generally participate eagerly in role-playing situations.

SA 14% A 46% U 16% D 16% SD 0%

9. Participation in the design and manufacture of the various products provides students with an opportunity to develop a variety of technical performance skills.

SA 16% A 54% U 19% D 11% SD 0%

10. The coat hanger activity is an effective method of having students experience the advantages of mass-production processes over hand processes.

SA 78% A 16% U 0% D 3% SD 0% NR 3%

11. Generally students are motivated to make the products which appear in the laboratory manual.

SA 24% A 65% U 3% D 3% SD 0%

12. The laboratory manual provides an adequate number and variety of products.

SA 32% A 54% U 8% D 14% SD 3%

13. Students develop research skills (retrieving, experimenting,and describing) when they participate in the manufacture of the model rocket and Land Speed Record Assault Vehicle (LSRAV).

SA 32% A 54% U 8% D 5% SD 0%

14. Designing and engineering the LSRAV provides students with a realistic picture of current manufacturing processes.

SA 24% A 51% U 19% D 5% SD 0%

15. Abstract concepts such as forming, separating, bonding,and combining can be readily understood by students once they have used these processes to produce products.

SA 30% A 46% U 14% D 8% SD 0% NR 3%

16. Given a specific process such as drop forging, a student who has completed the manufacturing course should be able to classify this process under the broad category of forming by compressing or stretching.

SA 22% A 43% U 24% D 54% SD 0% NR 5%

17. Short activities such as the "Story of Basic Machine Tools" and the "Story of Rubber Products" are interesting to students.

SA 11% A 43% U 27% D 3% SD 0% NR 14%

18. The activity entitled "Story of the Telephone" is an effective method of having students apply such concepts as forming, separating, and combining.

SA 3% A 38% U 19% D 8% SD 8% NR 22%

19. Students are interested and enjoy the activities dealing with manufacturing production practices such as the manufacture of the various products.

SA 38% A 47% U 3% D 3% SD 0%

20. Students are interested and enjoy the activities that deal with management practices, such as playing Big Manufacturer or designing and engineering a manufacturing plant.

SA 3% A 43% U 30% D 22% SD 3% NR 3%

21. Students are interested and enjoy participating in lab activities dealing with personnel practices such as hiring, training, advancing, and retiring.

SA 11% A 38% U 27% D 22% SD 0% NR 3%

22. Students are generally not disappointed with their "take-home projects" in the manufacturing course.

SA 32% A 54% U 0% D 5% SD 3% NR 5%

23. Planning, designing, and manufacturing of the high-intensity desk lamp is adequately organized and presented in the laboratory manual.

SA 16% A 38% U 14% D 54% SD 0% NR 24%

24. Students generally read, understand, and follow the procedures listed in the laboratory manual.

SA 0% A 38% U 11% D 30% SD 16%

25. Students reading between the 7th and 9th grade levels can understand the information in the laboratory manual.

SA 5% A 59% U 14% D 11% SD 0% NR 11%

26. Performing the activities in the nine-week corporation segment provides students with a more thorough understanding of manufacturing technology.

SA 22% A 27% U 14% D 5% SD 0% NR 32%

27. Students are interested in participating in the corporation activities.

SA 5% A 30% U 24% D 5% SD 3% NR 32%

28. Adequate proportions of group activities and individual activities have been utilized in the laboratory manual.

SA 8% A 38% U 16% D 16% SD 5% NR 14%

29. A good way of imitating manufacturing practices in the school is to have students work together as members of management and production groups.

SA 27% A 54% U 0% D 5% SD 0% NR 14%

30. Students usually complete the charts and questions which are found in various units of the laboratory manual.

SA 5% A 38% U 11% D 32% SD 0% NR 14%

31. Students who complete the charts and questions in the laboratory manual generally learn more about manufacturing technology than those who do not complete the charts and questions.

SA 24% A 43% U 14% D 5% SD 0% NR 14%

32. Time allotment for completion of laboratory activities is generally satisfactory.

SA 3% A 32% U 11% D 32% SD 11% NR 11%

33. Overall, the laboratory manual is well designed to withstand daily use by the student during his study of manufacturing.

SA 16% A 51% U 8% D 5% SD 8% NR 11%

MANUFACTURING TEACHER'S GUIDE

34. The Teacher's Guide is designed and organized to help the teacher perform efficiently and effectively.

SA 46% A 51% U 3% D 0% SD 0%

35. Behavioral objectives listed for the assignments in the Teacher's Guide are clearly stated, understandable, and obtainable.

SA 16% A 59% U 14% D 8% SD 3%

36. Directions for organizing and conducting laboratory activities can be easily understood by the IACP teacher.

SA 22% A 54% U 14% D 8% SD 0% NR 3%

37. A durable loose leaf binder would be a better method for binding the Teacher's Guide.

SA 54% A 38% U 8% D 0% SD 0%

38. The type face and size used in the Teacher's Guide facilitates the reading of the material.

SA 27% A 54% U 11% D 3% SD 3%

39. After completing the daily assignments, students can generally satisfy the objectives listed for the text.

SA 3% A 62% U 16% D 19% SD 0%

40. After completing the daily assignments, students can generally satisfy the objectives listed for the discussion.

SA 5% A 78% U 11% D 0% SD 3%

41. After completing the daily assignments, students can generally satisfy the objectives listed for the laboratory activities.

SA 8% A 70% U 19% D 3% SD 0%

42. Equipment and supply lists in the Teacher's Guide are accurate, comprehensive, and useful.

SA 43% A 30% U 3% D 3% SD 22%

43. Things to be deomonstrated by the teacher are adequately explained in the Teacher's Guide.

SA 5% A 68% U 19% D 3% SD 5%

44. Instructions for conducting the model rocket activities are satisfactory.

SA 5% A 49% U 8% D 24% SD 8% NR 5%

45. Instructions for conducting the LSRAV activity are satisfactory.

SA 16% A 78% U 0% D 5% SD 0%

46. Instructions for conducting the manufacture of the high-intensity desk lamp are satisfactory.

SA 8% A 42% U 19% D 5% SD 3% NR 22%

47. Safety precautions for laboratory activites are adequately covered in the Teacher's Guide.

SA 3% A 73% U 11% D 11% SD 3%

48. Periodic review periods, prior to tests,help students further understand concepts learned in previous lessons.

SA 14% A 59% U 24% D 0% SD 3%

49. The number of textbook readings assigned for homework per week is realistic.

SA 5% A 54% U 19% D 14% SD 8%

50. Information in the discussion and presentation sections of the Teacher's Guide is written so that it can be easily presented to students.

SA 14% A 84% U 3% D 0% SD 0%

51. The table of contents used in the Teacher's Guide is accurate, comprehensive, and useful.

SA 24% A 59% U 8% D 3% SD 3% NR 3%

52. The slides entitled "Introduction to The World of Manufacturing" provide the student with an interesting overview of the manufacturing course.

SA 43% A 46% U 8% D 3% SD 0%

53. Filmstrips show up-to-date practices of manufacturing technology.

SA 11% A 59% U 16% D 8% SD 5%

54. Generally students are interested in viewing the filmstrips which deal with manufacturing technology.

SA 5% A 49% U 30% D 16% SD 0%

55. Filmstrip scripts are accurate, concise, and descriptive.

SA 0% A 62% U 24% D 11% SD 3%

56. Overhead transparencies used in the course are helpful in teaching about manufacturing technology.

SA 14% A 49% U 24% D 11% SD 0%

57. On an overall basis, "hardware" used in the manufacturing course is functional.

SA 16% A 70% U 5% D 5% SD 0%

58. "Hardware" used in the manufacturing course can withstand continuous student usage.

SA 0% A 32% U 16% D 35% SD 16%

59. Achievement test results provide teachers with useful information relative to student performance that may be used to improve the teaching-learning process.

SA 16% A 42% U 27% D 14% SD 3%

60. Manufacturing achievement tests provide one valid measure concerning how well the student has learned about manufacturing technology.

SA 11% A 51% U 27% D 14% SD 0%

61. The results of achievement tests should be used primarily to evaluate (assign a course letter grade) students.

SA 0% A 11% U 16% D 54% SD 14% NR 5%

62. Achievement test results, along with other teacher assessments of student performance, can provide the teacher with useful information when formulating course grades.

SA 24% A 68% U 5% D 0% SD 0% NR 3%

63. There is an adequate number of achievement tests given during the manufacturing course.

SA 22% A 54% U 3% D 8% SD 14%

MANUFACTURING TEXTBOOK

64. The textbook presents an accurate and complete story of "The World of Manufacturing" for junior high school students.

SA 46% A 42% U 8% D 5% SD 0%

65. The subject matter in the radings appears to be appropriate for the maturation level of junior high school age students.

SA 8% A 49 U 16% D 24% SD 0% NR 3%

66. The major practices used in present-day manufacturing have been included in the textbook readings.

SA 27% A 70% U 3% D 0% SD 0%

67. The organization of the text readings which include an introduction, body of information, summary, terms to know, and review questions, appears to be a good design for improving student achievement.

SA 22% A 73% U 3% D 3% SD 0%

68. The readings can be readily understood by students with a reading ability between the 7th and 9th grade levels.

SA 11% A 54% U 16% D 14% SD 5%

69. Frequent use of illustrations and photographs in the text aid students in understanding the concepts which are covered in the readings.

SA 32% A 57% U 11% D 0% SD 0%

70. Junior high school age students who are reading below the 7th grade level can readily understand the text readings.

SA 0% A 5% U 24% D 49% SD 19% NR 3%

71. Teaching-learning aids such as cognitive maps, "Terms to Know" and "Think About It" questions are utilized by the student.

SA 5% A 32% U 32% D 24% SD 3% NR 3%

72. Cognitive maps located at the end of each reading, help students to conceptualize and synthesize what they have read.

SA 14% A 35% U 43% D 8% SD 0%

73. The "Terms to Know" section of each reading helps students to better understand the information presented in the readings.

SA 14% A 62% U 14% D 8% SD 0%

74. The "Think About It" questions in the textbook helps students to synthesize and apply the concepts covered in the readings.

SA 11% A 54% U 22% D 11% SD 3%

75. The sequence of readings in the textbook appears appropriate.

SA 0% A 76% U 14% D 5% SD 15%

76. The type face and size used in the text body, captions, headings and subheadings are adequate for junior high school age children.

SA 8% A 86% U 5% D 0% SD 0%

77. Photographs and illustrations used in the text are attractive and of professional quality.

SA 16% A 62% U 14% D 8% SD 0%

78. Photographs and illustrations used in the text accurately portray current manufacturing practices.

SA 22% A 68% U 8% D 3% SD 0%

79. Photographs and illustrations in the text help students to <u>better</u> understand manufacturing practices discussed in the textbook.

SA 35% A 57% U 8% D 0% SD 0%

80. Manufacturing processes portrayed in the text are accurate and up-to-date.

SA 27% A 59% U 14% D 0% SD 0%

81. Color is adequately used throughout the text to produce an appealing book.

SA 0% A 5% U 11% D 35% SD 30% NR 11%

82. To have a good understanding of manufacturing technology, it is necessary for students to read the textbook as well as perform the laboratory activities.

SA 46% A 30% U 3% D 19% SD 0%

83. Concepts covered in the textbook readings are reinforced through subsequent laboratory activities.

SA 43% A 46% U 5% D 3% SD 0%

84. Students find the text readings interesting and appealing.

SA 3% A 30% U 24% D 30% SD 14%

85. The table of contents and index which appear in the text are comprehensive, accurate, and adequate for student and teacher use.

SA 16% A 73% U 3% D 5% SD 3%

86. The quality and durability of text binding, paper, and cover stock is adequate for school use.

SA 3% A 19% U 24% D 42% SD 5% NR 8%

Exhibit 3

Accomplishment of Objectives for
Construction and Manufacturing
(Ratings by Teachers)

ACCOMPLISHMENT OF OBJECTIVES: CONSTRUCTION

Listed below are the three objectives of industrial arts and twelve objectives of "The World of Construction" as stated in the Teacher's Guide. Please rate each objective as you feel it is accomplished in "The World of Construction" course by placing the appropriate number in the blank.

5 = completely accomplished
4 = almost completely accomplished
3 = partially accomplished
2 = almost not accomplished
1 = not accomplished

Average Rating (N = 33)	
	OBJECTIVES OF INDUSTRIAL ARTS
	A study of industrial arts serves these purposes:
4.1	1. Enables students to understand the concepts, principles, generalizations, problems, and strategies of industrial technology.
4.0	2. Encourages an interest in and an appreciation for industry as that element of the economic system that provides industrial material goods for the satisfaction of human wants for those goods.
4.0	3. Provides knowledge and skills that will be useful in life situations of occupational, recreational, consumer, and sociocultural significance.
	OBJECTIVES OF THE WORLD OF CONSTRUCTION
	This course will enable the student to do the following:
4.3	1. Place construction technology in the broader context of industrial technology and all of technology.
4.1	2. Appreciate, understand, and perform selected management practices in planning, organizing, and controlling as they relate to construction production systems.
4.0	3. Appreciate, understand, and perform selected personnel practices as they relate to a managed production system in construction
4.1	4. Appreciate, understand, and perform selected production practices in preprocessing, processing, and postprocessing or servicing as they apply to construction production systems.

4.0	5.	Appreciate and understand the interrelationships within and between management, personnel, and production practices.
4.4	6.	Appreciate and have some understanding of constructed projects and the tools and materials utilized in their construction.
3.8	7.	Utilize knowledge of construction techniques outside the classroom, currently and in the future.
3.9	8.	Understand the interrelationship of construction technology and community development.
4.4	9.	Develop an awareness of vocations in construction technology.
4.0	10.	Develop an awareness of the significance of construction technology in the past, present, and future.
4.1	11.	Develop responsible and safe working attitudes and the ability to function as a member of a group.
3.8	12.	Develop an awareness of self-realization and generate self-actuating behaviors.

ACCOMPLISHMENT OF OBJECTIVES: MANUFACTURING

Listed below are the three objectives of industrial arts and eleven objectives of "The World of Manufacturing" as stated in the Teacher's Guide. Please rate each objective as you feel it is accomplished in "The World of Manufacturing" course by placing the appropriate number in the blank.

5 = completely accomplished
4 = almost completely accomplished
3 = partially accomplished
2 = almost not accomplished
1 = not accomplished

Average Rating (N = 33)	OBJECTIVES OF INDUSTRIAL ARTS
	A study of industrial arts serves these purposes:
4.0	1. Enables students to understand the concepts, principles, generalizations, problems, and strategies of industrial technology.
4.0	2. Encourages an interest in and an appreciation for industry as that element of the economic system that provides industrial material goods for the satisfaction of human wants.
4.0	3. Provides knowledge and skills that will be useful in life situations of occupational, recreational, consumer, and sociocultural significance.
	OBJECTIVES OF THE WORLD OF MANUFACTURING
	This course will enable the student to do the following:
4.3	1. Place manufacturing technology in the broader context of industrial technology and all of technology.
4.0	2. Be aware of the history, present character, and future of the manufacturing phase of industry.
3.9	3. Appreciate, understand, and perform selected management practices in planning, organizing, and controlling as they relate to manufacturing production systems.
3.7	4. Appreciate, understand, and perform selected personnel practices of hiring, training, working, advancing, and retiring as they relate to a managed production system in manufacturing.
4.0	5. Appreciate, understand, and perform selected production practices in preprocessing, processing, and postpro-

cessing or servicing as they apply to manufacturing production systems.

4.0	6.	Appreciate and understand the interrelationships within and between management, personnel, and production practices.
4.3	7.	Appreciate and have some understanding of manufactured products and the tools and materials utilized in their manufacture.
4.4	8.	Utilize the knowledge and skills of manufacturing management and production to investigate factors involved in the manufacture of representative products.
3.9	9.	Develop an awareness of vocations in manufacturing industries.
3.9	10.	Develop responsible and safe working attitudes and the ability to function as a member of a group.
3.8	11.	Develop an awareness of self-realization and generate self-actuating behaviors.

APPENDIX K

Construction Personnel Responses in Percentage Totals Regarding General and Textbook Questionnaires

IACP CONSTRUCTION - GENERAL QUESTIONNAIRE

Please circle one of the following for each statement:
SA=Strongly Agree, A=Agree, U=Undecided, D=Disagree, SD=Strongly Disagree

1. The IACP construction course is a worthwhile instructional program for secondary school children.

SA 92.3% A 7.7% U 0% D 0% SD 0%

2. Students who complete the study of construction should have a good basic knowledge of the use of hand and power tools.

SA 36.3% A 36.3% U 28.5% D 0% SD 0%

3. A student who studies construction should have a better understanding of a variety of career or occupational opportunities than a student who completes a conventional industrial arts course (woodshop, metalshop, and drafting).

SA 72.4% A 13.8% U 13.8% D 0% SD 0%

4. Construction students should have a better understanding of the materials and practices used in construction technology than students who study conventional industrial arts (woodshop, metalshop, and drafting).

SA 84.4% A 7.8% U 7.8% D 0% SD 0%

5. The study of construction gives students a more comprehensive understanding of the "world of work" than they would obtain from a conventional junior high program.

SA 84.4% A 7.8% U 7.8% D 0% SD 0%

6. The study of construction presents as accurate a picture of construction technology as is possible in a school setting.

SA 70.6% A 13.8% U 7.8% D 7.8% SD 0%

7. All junior high students would benefit from studying construction.

SA 53.7% A 30.7% U 7.8% D 0% SD 0%

IACP CONSTRUCTION TEXTBOOK QUESTIONNAIRE

Please circle one of the following for each statement:
SA=Strongly Agree, A=Agree, U=Undecided, D=Disagree, SD = Strongly Disagree

1. The textbook presents an accurate and complete story of "The World of Construction" for junior high school students.

   SA 63.6% A 18.2% U 9.1% D 9.1% SD 0%

2. The sequence of readings appears appropriate and logical to provide an accurate story of construction.

   SA 45.4% A 45.5% U 0% D 9.1% SD 0%

3. The major practices used in present-day construction have been included in the textbook reading titles and subheadings.

   SA 27.3% A 63.6% U 0% D 0% SD 9.1%

4. Construction processes portrayed in the text are accurate and up-to-date.

   SA 27.3% A 72.7% U 0% D 0% SD 0%

5. The organization of the text readings which include an introduction, body of information, summary, terms to know, and review questions, appears to be a good format for informing students about construction.

   SA 36.4% A 63.6% U 0% D 0% SD 0%

6. The "cognitive maps" located at the end of each reading, accurately portray the relationship of the concepts.

   SA 18.2% A 81.8% U 0% D 0% SD 0%

7. The "Terms to Know" at the end of each reading lists the important technical and difficult terms in each reading.

   SA 27.3% A 72.7% U 0% D 0% SD 0%

8. The "Think About It!" questions at the end of each reading represent an application of important concepts.

   SA 27.3% A 72.7% U 0% D 0% SD 0%

9. The type face and size used in the text body, legends, and headings and subheadings are easily read.

SA 36.4% A 63.6% U 0% D 0% SD 0%

10. Photographs and illustrations used are attractive and of professional quality.

SA 18.2% A 81.8% U 0% D 0% SD 0%

11. Photographs and illustrations accurately represent current construction practices.

SA 9.1% A 90.9% U 0% D 0% SD 0%

12. Photographs and illustrations expand on the concepts by providing additional information.

SA 27.3% A 72.7% U 0% D 0% SD 0%

13. The table of contents and index which appear in the text are comprehensive, accurate, and adequate.

SA 36.4% A 63.6% U 0% D 0% SD 0%

14. The quality and durability of text binding, paper, and cover stock is adequate for school use.

SA 45.4% A 45.4% U 9.1% D 0% SD 0%

15. The design and appearance of the book is interesting and attractive.

SA 54.5% A 36.4% U 9.1% D 0% SD 0%

16. The textbook presents an adequate and fair description of the role of management in construction.

SA 27.3% A 54.5% U 18.2% D 0% SD 0%

17. Management is presented more favorably than is labor.

SA 0% A 0% U 18.2% D 81.8% SD 0%

18. The textbook presents an adequate and fair description of the role of labor in construction.

SA 9.1% A 63.6% U 18.2% D 9.1% SD 0%

19. Labor is presented more favorably than is management.

SA 0% A 9.1% U 18.2% D 63.6% SD 9.1%