



this **ACIATE/CTTE yearbook** was

scanned at the department of

**Technology and Engineering Education,**

Central Connecticut State University



...by Johnny Kassay and Pat Foster from the collections of several educators, including David Sianez and James DeLaura.

**Responsibility for any copyright infringement is claimed by Patrick N. Foster.** We plan to improve this document by re-scanning, adding links, and/or direct neural input.

**22<sup>nd</sup>**  
yearbook

*American Council on  
Industrial Arts Teacher Education*

**INDUSTRIAL ARTS IN  
SENIOR  
HIGH  
SCHOOLS**



# INDUSTRIAL ARTS IN SENIOR HIGH SCHOOLS

RUTHERFORD E. LOCKETTE

Editor  
University of Pittsburgh  
Pittsburgh, Pennsylvania 15213

**22nd  
yearbook**

*American Council on  
Industrial Arts Teacher Education*

A Division of the American Industrial Arts Association  
and the National Education Association



**Copyright 1973**

**American Council on Industrial Arts Teacher Education**

*All rights reserved. No part of this book may be reproduced, in any form, without permission in writing from the American Council on Industrial Arts Teacher Education.*

Lithographed in U.S.A.

Yearbooks of the American Council  
on Industrial Arts Teacher Education  
are produced and distributed by the  
McKnight Publishing Company,  
Bloomington, Illinois

**Orders and requests for information about cost and availability  
of yearbooks should be addressed to the company.**

Requests to quote portions of yearbooks  
should be addressed to the Secretary,  
American Council on Industrial Arts Teacher Education,  
in care of the publisher, for forwarding  
to the current Secretary.

# Foreword

Over the years, there has been some confusion regarding the role of industrial arts at the high school level. At a time when broad new programs of career education, occupational education, or "world-of-work" oriented approaches are in vogue, it is especially important to reexamine the contributions of industrial arts to high school youth.

For decades, members of the profession have shown concern for the philosophical considerations which should be interpreted into actions through programs and activities in shops, laboratories, and classrooms. This yearbook, too, attempts to place our discipline in perspective by showing the relationships between the social order and the high school in general, with special emphasis on high school industrial arts programs.

This yearbook is indeed a welcomed addition to the literature of our field. Its format and content should lead ultimately to a clearer indication of the potential of industrial arts as our discipline endeavors to make significant contributions to American secondary education.

The ACIATE acknowledges the leadership of the editor, Rutherford E. Lockette, and the contributions of the chapter authors. A new level of wisdom within the profession should be the result of this work.

Again the Council wishes to express its gratitude for the efforts of the McKnight Publishing Company. Without such philanthropy, this yearbook series would not exist.

Willis E. Ray  
President, ACIATE

# Yearbook Planning Committee

## *Terms Expiring 1973*

Donald F. Hackett

Georgia Southern College, Statesboro, Georgia

John Mitchell

Gorham State College, Gorham, Maine

## *Terms Expiring 1974*

Daniel L. Householder

Purdue University, Lafayette, Indiana

Rutherford E. Lockette

University of Pittsburgh, Pittsburgh, Pennsylvania

## *Terms Expiring 1975*

Horace O. Schorling

Fresno State College, Fresno, California

Earl M. Weber

Millersville State College, Millersville, Pennsylvania

## *Terms Expiring 1976*

Willis E. Ray

The Ohio State University, Columbus, Ohio

William T. Sargent

Ball State University, Muncie, Indiana

## *Terms Expiring 1977*

John A. Fuzak

Michigan State University, East Lansing, Michigan

Kenneth Phillips

California State University, Los Angeles, California

Donald G. Lux, *Chairman and Past-President of the Council*

The Ohio State University, Columbus, Ohio

## Officers of the Council

Willis E. Ray, *President*

The Ohio State University, Columbus, Ohio

David L. Jelden, *Vice-President*

University of Northern Colorado, Greeley, Colorado

Ervin A. Dennis, *Secretary*

University of Wisconsin—Stout, Menomonie, Wisconsin

Lawrence S. Wright, *Treasurer*

University of Wisconsin—Stout, Menomonie, Wisconsin

# Yearbook Proposals

Each year, at the AIAA national convention, the ACIATE Yearbook Committee reviews the progress of yearbooks in preparation and evaluates proposals for additional yearbooks. Any member is welcome to submit a yearbook proposal. It should be written in sufficient detail for the committee to be able to understand the proposed substance and format, and sent to the committee chairman by February 1 of the year in which the convention is held. Below are the criteria employed by the committee in making yearbook selections.

ACIATE Yearbook Committee

## Guidelines for ACIATE Yearbook Topic Selection

With reference to a specific yearbook topic:

1. It should make a direct contribution to the understanding and the improvement of industrial arts teacher education.
2. It should avoid duplication of the publications activities of other professional groups.
3. It should confine its content to professional education subject matter of a kind that does not infringe upon the area of textbook publication which treats a specific body of subject matter in a structured, formal way.
4. It should not be exploited as an opportunity to promote and publicize one man's or one institution's philosophy unless the volume includes other similar efforts that have enjoyed some degree of popularity and acceptance in the profession.
5. While it may encourage and extend what is generally accepted as good in existing theory and practice, it should also actively and constantly seek to upgrade and modernize professional action in the area of industrial arts teacher education.

6. It can raise controversial questions in an effort to get a national hearing and as a prelude to achieving something approaching a national consensus.
7. It may consider as available for discussion and criticism any ideas of individuals or organizations that have gained some degree of acceptance as a result of dissemination either through formal publication, through oral presentation, or both.
8. It can consider a variety of seemingly conflicting trends and statements emanating from a variety of sources and motives, analyze them, consolidate and thus seek out and delineate key problems to enable the profession to make a more concerted effort at finding a solution.

Approved, Yearbook Planning Committee  
March 15, 1967, Philadelphia, Pa.

# Previously Published Yearbooks

1. *Inventory-Analysis of Industrial Arts Teacher Education Facilities, Personnel and Programs*, 1952. Walter R. Williams, Jr. and Harvey Kessler Meyer, eds.
- \* 2. *Who's Who in Industrial Arts Teacher Education*, 1953. Walter R. Williams, Jr. and Roy F. Bergengren, Jr., eds.
- \* 3. *Some Components of Current Leadership. Roy F. Bergengren, Jr. Techniques of Selection and Guidance of Graduate Students.* George F. Henry. *An Analysis of Textbook Emphases.* Talmage B. Young. 1954, three studies.
- \* 4. *Superior Practices in Industrial Arts Teacher Education*, 1955. R. Lee Hornbake and Donald Maley, eds.
- \* 5. *Problems and Issues in Industrial Arts Teacher Education*, 1956. C. Robert Hutchcroft, ed.
- \* 6. *A Sourcebook of Readings in Education for Use in Industrial Arts and Industrial Arts Teacher Education*, 1957. Carl Gerbracht and Gordon O. Wilbur, eds.
- \* 7. *The Accreditation of Industrial Arts Teacher Education*, 1958. Verne C. Fryklund, ed., and H. L. Helton.
- \* 8. *Planning Industrial Arts Facilities*, 1959. Ralph K. Nair, ed.
- \* 9. *Research in Industrial Arts Education*, 1960. Raymond Van Tassel, ed.
10. *Graduate Study in Industrial Arts*, 1961. Ralph P. Norman and Ralph C. Bohn, eds.
- \*11. *Essentials of Preservice Preparation*, 1962. Donald G. Lux, ed.
- \*12. *Action and Thought in Industrial Arts Education*, 1963. Ethan A. T. Svendsen, ed.
- \*13. *Classroom Research in Industrial Arts*, 1964. Charles B. Porter, ed.
14. *Approaches and Procedures in Industrial Arts*, 1965. G. S. Wall, ed.
15. *Status of Research in Industrial Arts*, 1966. John D. Rowlett, ed.
16. *Evaluation Guidelines for Contemporary Industrial Arts Programs*, 1967. Lloyd P. Nelson and William T. Sargent, eds.
17. *A Historical Perspective of Industry*, 1968. Joseph F. Leutkemeyer, Jr., ed.
18. *Industrial Technology Education*, 1969. C. Thomas Dean and Nelson A Hauer, eds.  
*Who's Who in Industrial Arts Teacher Education*, 1969. John M. Pollock and Charles A. Bunten, eds.
19. *Industrial Arts for Disadvantaged Youth*, 1970. Ralph O. Gallington, ed.
20. *Components of Teacher Education*, 1971. Willis E. Ray and Jerry Streichler, eds.
21. *Industrial Arts for the Early Adolescent*, 1971. Daniel L. Householder, Editor.

\* Out-of-print yearbooks can be obtained on microfilm and in Xerox copies. For information on price and delivery, write directly to University Microfilms Inc., 313 N. First Street, Ann Arbor, Michigan 48107.



# Contents

Preface . . . 13

**SECTION I. Societal Forces to Which the School Should Respond: The State of Affairs**

*Chapter 1.* Participatory Technology and Industrial Arts Education . . . 18  
MELVIN KRANSBURG

*Chapter 2.* Major Societal Forces Affecting Schools in the 70's . . . 35  
DEBORAH PARTRIDGE WOLFE

**SECTION II. The Role of the American Public High School**

*Chapter 3.* Secondary Schools in Perspective . . . 56  
LESTER ANDERSON

**SECTION III. Senior High School Industrial Arts Programs: A Study of Careers**

*Chapter 4.* Industrial Arts and Career Education: Focus on Homogenization . . . 71  
DOUGLAS PINE

*Chapter 5.* Senior High School Industrial Arts Programs: A Study of Careers Through the Use of Community Resources . . . 102  
ROBERT J. ULLERY

*Chapter 6.* Industrial Arts Career Education . . . 110  
R. J. EGAN

**SECTION IV. Senior High School Industrial Arts Programs: A Study of Industry**

*Chapter 7.* The Role of Industrial Arts in the Senior High . . . 121  
JOHN MITCHELL

*Chapter 8.* The Orchestrated System Focus Upon Industrial Arts for the Senior High School . . . 141  
LEWIS W. YOHO

**SECTION V. Senior High School Industrial Arts Programs:  
Meeting Students Needs**

- Chapter 9.* Meeting the Needs of the Gifted Student:  
Senior High School Industrial Arts Program . . . 156  
ERNEST G. BERGER
- Chapter 10.* An Experimental, Interdisciplinary Career  
Program, Designed for the Non-Academic Students in  
the New York City High Schools . . . 170  
GORDON LEBOWITZ
- Chapter 11.* Pittsburgh's Industrial Arts Programs are  
Performance Oriented and Designed to Meet  
Student's Needs . . . 177  
JERRY C. OLSON

**SECTION VI. Senior High School Industrial Arts Programs:  
A Study of Technology**

- Chapter 12.* Education in a Technological Society:  
"Access to Tools" . . . 199  
PAUL W. DEVORE
- Chapter 13.* Industrial Arts:  
The Study of Industrial Technology . . . 217  
DONALD F. HACKETT
- Chapter 14.* An Upward Extension of the Industrial Arts  
Curriculum Project Junior High School Program . . . 232  
DONALD G. LUX AND WILLIS E. RAY
- Chapter 15.* The Application of Technology in the Solution  
of Major Problems that Face Mankind  
in the Future . . . 260  
DONALD MALEY

**SECTION VII. Assessment of Industrial Arts Programs  
in the American Public High School**

- Chapter 16.* A Social Critique of Industrial Arts  
Education . . . 287  
LAWRENCE S. BERLIN
- Chapter 17.* A Critique of Eleven Papers Discussing Industrial  
Arts in the Senior High School . . . 301  
RON EDMONDS
- Index . . . 307**

# Preface

The American Council on Industrial Arts Teacher Education (ACIATE), with the cooperation of McKnight Publishing Company, has sponsored a yearbook each year for a number of years. This issue is the twenty-second in the series. They have dealt with pertinent topics in Industrial Arts Education. Therefore, they have contributed significantly to this field. When the idea was presented to the ACIATE Yearbook Committee that there existed a need for yearbooks which presented an overview of Industrial Arts at the various levels of education, it was accepted by the Committee as a good one. The titles and authors which consider these levels are presented below:

1. *Components of Teacher Education*. Willis Ray and Jerry Streichler, Editors. (1971)
2. *Industrial Arts for the Early Adolescent*. Daniel Householder, Editor. (1972)
3. *Industrial Arts for the Senior High School*. Rutherford E. Lockette, Editor. (1973)
4. *Industrial Arts for the Elementary School*. Robert Thrower and Art Thieme, Editors. (1974) (In Process)

This 1973 topic presented a very real problem to editors who attempted to develop an outline acceptable to the Yearbook Committee. The numerous views held by vocal Industrial Arts leaders with regard to the role of Industrial Arts at the high school level are in conflict, particularly as Industrial Arts relates to the world of work. Another problem stemmed from attempts to apply previously employed formats to this issue. Many, if not most, of the vocal Industrial Arts leaders had not published their views on the role of Industrial Arts in the senior high school, at least in recent years. It was felt that this would have made such a work too vulnerable to attack from them and lessened its worth to the field.

The plan of the Yearbook attempted to avoid these problems and comply with the criteria presented below:

1. The editor should be objective in dealing with the various views on Industrial Arts in the high school. He should not be controversial.
2. If at all possible, all manuscripts accepted would be presented in their entirety.

These criteria were met.

The plan for the Yearbook further called for its being presented in seven major sections. Section I contains chapters on the "Societal Forces To Which The School Should Respond—The State of Affairs." This section is designed to draw attention to the various forces at work in our country and in the world which have implications for the design of educational programs. Section II deals with "The Role of the American Public High School." This chapter presents a discussion of the role of the American public high school within the total framework of the educational institution. Sections, III, IV, V and VI contain chapters by Industrial Arts educators on their view of the role of Industrial Arts in the senior high school. Each author was asked to determine in which of the four sections his manuscript would be placed. The titles of these sections are:

1. Section III—A Study of Industry
2. Section IV—A Study of Technology
3. Section V —A Study of Careers
4. Section VI—Meeting Students' Needs

The format which was suggested to authors for their manuscripts is presented below:

1. Name of Program
2. Philosophical Rationale
3. Psychological Rationale
4. Program Description
  - a. Content
  - b. Activities
  - c. Instructional Strategies (Methods)
  - d. Instructional Materials
  - e. Facilities Required
  - f. Program Evaluation

It was thought that this format would be of assistance in presenting a complete program description.

Section VII is titled, "Assessment of Industrial Arts Programs in the American Public High School." The purpose of this section is to comment upon the Industrial Arts programs described, their contribution to the role of the American public high school and their cognizance of the societal forces to which the schools should respond.

ACIATE in general, and the editor in particular, is grateful to all of the Industrial Arts authors whose manuscripts appear in this Yearbook. Special mention should be made of the contributions of individuals whom, although knowledgeable about Industrial Arts, are from outside of this field. Dr. Melvin Kransberg and Dr. Deborah Wolfe presented excellent manuscripts dealing with the "Societal Forces To Which Schools Should Respond—The State of Affairs." Dr. Lester Anderson's chapter, which deals with "The Role of the American Public High School," is indeed an excellent treatment. Mr. Larry Berlin and Mr. Ron Edmonds provided insightful critiques of the Industrial Arts chapters.

It is hoped that this Yearbook will result in Industrial Arts leaders focusing on the weaknesses of their positions with the view of improving them. It is also hoped that this Yearbook might stimulate debates which will result in a stronger position of Industrial Arts Education's role in the American public high school.

Rutherford E. Lockette



SECTION I

**Societal Forces to Which  
The School Should Respond:  
The State of Affairs**

# Participatory Technology and Industrial Arts Education

*Melvin Kranzberg  
Callaway Professor of the History of Technology  
Georgia Institute of Technology  
Atlanta, Georgia*

As the little 350-ton *Arbella* spread its sails on its stormy voyage across the Atlantic to the Massachusetts coast in 1630, John Winthrop prophesied to his people on their future in the New World: "We shall be as a city upon a hill; the eyes of all people are upon us." For most of American history, Winthrop's prophecy seems to have been right on the mark. America's material prosperity and freedom have been a source of envy throughout the world; the economic opportunity afforded by our vast country served as a magnet attracting the persecuted, the adventurous, and the downtrodden; and America served as a model to be emulated by liberty-loving people everywhere.

Yet within the past decade the gleaming vision of the "city upon a hill" has become tarnished. Our growing industrial might has not resulted in a material utopia—and every step we take along the way to that goal makes it seem as if we are running madly on a gilded treadmill. As we approach the ideal of producing enough goods and services to provide middle-class comfort for all America, we still have an enormous number of people—estimated at 10% of the population—living at or below the poverty level. Our astronauts can whiz around the earth in less than an hour, and anyone with a credit card can have dinner in New York City and breakfast in London; yet suburban commuters can't get to work on

time. Our computers can solve in a few seconds mathematical problems that would require an individual fifty years to solve, our copying machines multiply papers faster than the sorcerer's apprentice could dump them in a trash can, and television and radio bring instant information to us; yet men feel less and less capable of understanding the world in which they live. Despite our vast communications network, people agonize as never before over "the failure to communicate." In 17th-century London, John Donne preached that "no man is an island," and technology has made this a reality through knitting an infinite number of threads of global communications and international trade. Yet this very dependency on our near and far neighbors fills us with fear: the breakdown of a distant electrical relay plunges us into darkness; strikes by truck drivers, garbage collectors, teachers, or policemen, can cut off our food, pile up mountains of refuse, or deprive us of education and security; the vagaries of international power politics can menace vital fuel and material resources; the actions of a few criminal terrorists can destroy airborne transportation, disrupt the harmony of international sports, end the careers of gifted and talented leaders, and threaten the vital but fragile threads of our highly complex industrial society.

We find ourselves baffled by this series of paradoxes. Who would have thought that this nation of almost unlimited resources, glorying in the enormous treasure that it extracted from the earth, would now be concerned by the profligate squandering of its treasury? Who would have thought that "America the beautiful" would be pockmarked by the rash of urban blight, the ugly scars of strip mining, and the varicose arteries of freeways? Who would have thought that the nation which a century ago fought four bloody years in order to retain its unity and ideals of human equality would now be torn asunder by tension and dissension transcending sectional lines? Who would have thought that liberty-loving Americans would no longer feel free to traverse the streets of their hometowns after nightfall? Who would have thought that our cities would become so large as to become virtually unmanageable, our traffic so heavy we might find it quicker to walk than to drive, that new school buildings would resemble medieval fortresses rather than fake Tudor palaces? Indeed, who would have dreamt,

except in a nightmare, that our system of public education, so long applauded for its role in developing America's industrial might and acculturating generations of youngsters to ideals of liberty and freedom, should now be attacked as undemocratic and as no longer meeting society's needs? And who would have guessed that when we finally reached the goal of providing virtually free higher education to the majority of our youth that our college youngsters should rebel against it and deem their education useless or irrelevant?

Yet this process of holding up a mirror to our shining ideals and seeing the spotted actuality reflected therein should not fill us with dismay or do-nothing pessimism. Instead, it should confront us with the challenges and opportunities which still lie ahead. For one thing, it provides us with a realistic appraisal of our actual capabilities and potentialities as well as the obstacles yet to be overcome. For another, much of the malaise which affects our times might not indicate that the American dream has ended in inglorious failure; instead, it might be the inevitable accompaniment of rapid sociocultural change, and the prelude to better-designed efforts to achieve the bright future of "a city upon a hill." In the broad perspective of history we might not yet have succeeded—but neither have we failed.

Indeed, some of the problems besetting us represent a continuation of our efforts to achieve the aims of our great American Revolution. We are still struggling to arrive at the goals of liberty and justice for all. Political freedom, we have learned, requires social justice; social justice demands equality of opportunity; equality of opportunity requires development of the nation's wealth in order to provide higher standards of living for all; and so it goes. At one time, democracy was primarily a political concept; we have broadened it into an economic, social, and cultural concept. The travails connected with this process have been so great that they sometimes seem to threaten the democratic process itself, especially because of the rapid social changes engendered by our democratic commitment and by our advancing science and technology.

\* \* \*

Near the beginning of the 19th century, the French nobleman Alexis de Tocqueville, setting down his impressions of the infant United States, remarked upon the tendency of the American people to organize into voluntary associations for the accomplishment of various tasks. Instead of leaving everything to the state, as was the habit in European countries, Americans banded together to perform various tasks which needed doing, or to persuade the government to do them. But as a result of growing industrialism, early 19th century liberal ideals of passive government—as opposed to the authoritarian states of the Old World—slowly gave ground to new concepts of the role of government. The change from a nation of isolated farmers pursuing individualistic methods of production to urban workers performing collective tasks in factories required an elaboration of governmental institutions and control. An increasingly complex and interdependent industrial society demanded legislation and administrative bureaucracies which had not been required in an earlier, more agrarian society.

As the pace of American industrialization—and hence of government action in the social system—has speeded up since World War II, it seemed to many that the democratic impulses of American life were losing out to “big business, big government, big everything.” The individual felt himself lost when confronting the impersonal bureaucratic hierarchies at every level of government, or believed himself at the mercy of giant corporations that seemed more concerned with profits than with the human and social consequences of their activities.

Faced with these developments, the American people harkened back to the practice noted by Tocqueville a century and a half ago; they began to seek more effective citizen participation in the government, in the economy, in society, and especially in the educational system. This movement, whose birth pangs have been accompanied by tension, dissension, and violence—and which at times seems to threaten the foundations of our democracy—is itself democratic in essence. It goes under the name of “participatory democracy.”

In the National Goals report of 1970, Daniel Moynihan, always a perceptive analyst of the American social condition, took note of this movement, declaring that there is “a fairly

direct evolution toward citizen participation in the actual workings of government." Had he wished, Moynihan might have probed further into this phenomenon and pointed out that citizen participation was not limited solely to government, but was also manifesting itself in education and technology. "Participatory education" and "participatory technology," ill-conceived as some of their manifestations might seem to us, represent an extension of the democratic process into new areas.

Participatory education means many things, some of them contradictory. Although public education presumably has always been a matter of public concern, in practice it had been left largely to professional educators, although sometimes local boards of education or state legislators tried to exercise some form of control. Parent-teacher associations were usually polite affairs, with parents content to meet the teachers socially and be satisfied with their explanations of how Mary and Johnny were doing at school. But within the past decade the isolation and insulation of professional educators have been violently shattered. In Northern urban areas containing large minority groups, the demand for "community control" of the schools led to violent confrontations and threatened the integrity of the educational process itself; in the Southern United States, "citizens' councils" sought control to achieve goals exactly opposite their counterparts among the ethnic minorities in the cities! Neither legislation nor judicial decision could satisfy both groups; they went either too far or did too little, depending upon the point of view. One thing was certain: the schools became battlegrounds in the great social and political issues of our times. The outcome of this struggle is still in doubt; nevertheless, it represents an historical phenomenon which all educators must take into account.

Another level of "participatory education" was at the student level. In institutions of higher learning, the demand was heard that students participate more in determining the conditions of their education. Gray-bearded professors and deans floundered in dismay as callow but longer-bearded youths clamored for a voice in what they should be taught and how they should be taught, and even demanded a role in the governance of universities. Permissiveness—perhaps too much, for some tastes—supplanted the authoritarian voice of the teacher; the

informal permissiveness which had become characteristic of the mobile and restless American family was thus reflected in our educational institutions.

It is not surprising that technology also became a target of this inchoate movement toward participatory democracy. After all, technology was the central factor in determining the conditions and meaning of life for Americans living in a highly urbanized, industrialized society. Technology's impact upon how men worked and lived was too potent to be ignored. If they wished to have control over their destinies, Americans sensed intuitively that they must also have some control over their technology.

The movement for participatory technology goes under several names: environmentalism, consumerism, accountability.

The possibility of technological damage to ecological systems was first forced upon the public consciousness only a decade ago, when Rachel Carson pointed out that the damage wrought by indiscriminate use of pesticides and fertilizers might bring us to a springtime when the birds no longer sang. The consumerist movement was fueled by crusaders like Ralph Nadar, who highlighted the inadequacy and shoddiness (and even the sometimes dangers) of the products offered by American industry. Both environmentalism and consumerism brought accountability to the fore: scientists, engineers, government officials, corporation executives, generals, and admirals—all would be held accountable for the human and social consequences of their uses of technology.

The public's concern forced governmental action. Within a short space of time, the Federal government instituted the Environmental Quality Protection Act and the Environmental Protection Board, safety equipment and emissions control for automobiles were legislated, DDT was banned, and the SST was dropped. Consumer protection boards were inaugurated by many local and state governments. And in 1972 Congress established an Office of Technology Assessment to monitor the social and human consequences of the applications of science and technology.

The development of participatory technology obviously has ramifications for our educational system. Society demands that knowledge be applied to social needs; at the same time our

students demand that their learning be relevant. This concern for social need is a hallmark of today's youth. Instead of deploring it, we should applaud it. Here is both a challenge and an opportunity for educators.

The challenge lies in the fact that technological advance is revolutionizing our economy, transforming our environment, and modifying our social institutions. Furthermore, technology is moving at such a fast pace that our institutional framework and our value system seem unable to keep up with it. The argument states that if we do not adjust our institutions—political, social, and economic—and our cultural nexus to cope with the transformations occurring in our technological life, citizens of the future will be faced unexpectedly with new situations which they will be unprepared to meet—and hence will suffer from “future shock,” as described by Alvin Toffler in his recent best-seller.

There are others who claim that the human nervous system and brain cannot cope with the impact of the accelerating technological changes which have become the hallmark of contemporary America. That is nonsense, as even a superficial glance at today's youth reveals. They accept and digest the products of technological progress without any nervous strain whatsoever. Indeed, they grew up with them, and they live their lives in a world of kaleidoscopic neon lights, pneumatic doors, hot-rods, jet planes, television, and the ubiquitous transistor radio. Any technology which promotes speed, comfort, and convenience is readily absorbed and becomes part of the very tissue of their daily existence.

What the youth cannot accept is the fact that our institutions—governmental, private, legal, economic, religious, and the like—have not adapted with equal ease or rapidity to this changing world. Paradoxically, our educational institutions have been among the most conservative in reacting to the rapid pace of technical change, yet they, more than any other factor, fueled the racing motor of technical progress. Let us therefore summarize briefly some of the major socio-technological changes which have occurred in recent American history, especially those which have most bearing upon the problems of vocational and industrial arts education.

\* \* \*

One of the major socio-technological changes of our times has been the transformation of America from a rural, agrarian society to an urban, industrialized society. The statistics tell the story. At the turn of the century, one American working on a farm produced food and fiber for eight people living in cities; by 1970 forty people in the cities were supported by the food and fibers produced by a single farmer. Whereas most people lived on farms or in small towns a century ago, now the great majority live in metropolitan areas, and their number is increasing daily.

This vast demographic movement from farm to city was made possible through an advancing technology: innovations which tremendously increased agricultural productivity, factories which mass-produced vast quantities of goods, and the concomitant development of transportation means and networks. Our factories, employing highly sophisticated machinery, provide us with such a great outpouring of goods that we no longer need so many production workers. Within the past two decades America has become the first major industrial nation where more people are engaged in service than production industries. It is predicted that the service sector (comprising trade, finance, government, transportation, and utilities) will show the most rapid gain in employment in the period from 1975-1980.

Both the production and service sectors of our economy are becoming more technically oriented, requiring workers with high levels of education and skill. The result has been what Charles Killingsworth of Michigan State University terms a "twist" in employment patterns from the non-technical to the technical, for there is diminishing need or place for unskilled labor in the American work force. In 1963, unskilled workers comprised 17% of the labor market, and the Department of Labor predicts this figure will be down to 5% by 1975.

Employers, both public and private, now demand higher educational levels for employees entering the work force, and students are being told that more education is the key to successful employment and to rising in the occupational ladder. Yet it is by no means clear that our advancing technology actually requires greater skill or higher education on the part of the large majority of the work force.

Ever since the Industrial Revolution a major trend in technological development has been to "build the skill into the machine." This certainly means that those who build and maintain the machines which are the major sources of our immense productivity must be highly trained and skilled. But does it mean that the operator of the machines must also possess skills—when the skills are already the possession of the machine itself? The worker is no longer a machine operator, but a machine overseer. Instead of actually performing a work operation himself, he watches the dials on a control panel. Since, by elaborate feedback mechanisms, the machine controls its own operations, some authorities suspect that we have overestimated the amount of skill required of the worker in a modern factory—although we have not overestimated the responsibility vested in the worker to whom this expensive equipment is entrusted.

Let us take a homely example of the lower skill level required by our sophisticated machinery. Large supermarket chains demand that the girls working at their checkout counters have at least a high school diploma. Does the work of the checkout girl really require even that minimum educational level? The customer brings the products to the counter; each product is clearly marked with its price, which the checkout girl punches on the cash register, which in turn computes the total automatically. The customer gives the checkout girl the money for the purchase; she punches that on the cash register, which then tells her how much change the customer should receive. The skill is built into the cash register; the checkout girl need not even know the elementary processes of addition and subtraction, because the machine performs these operations for her. All she has to do is to be able to read numbers and count money. In other words, the actual working skills required by the checkout counter girl were acquired by the time she reached the fifth grade!

The facts are clear enough, but the implications are not. It might well be that, as far as the actual operations of our production technology are concerned, the automated devices which are increasingly coming into use will require only limited skills for most occupations. Only a small group of highly skilled engineers and technicians will be required to design, produce,

and maintain the machines—and the machines will do all the work from that point on. Yet employers demand workers with higher educational levels. Furthermore, the employees themselves have higher expectations; they want jobs requiring more education.

Partly as a result of the feeling that more education is a prerequisite to economic advancement, American youth are going to college in greater numbers than ever before. This bias for a college degree seriously skews our educational—and eventually our economic—system. It means that elementary and secondary school education have been focused almost exclusively on college preparation. It means also that industrial arts and vocational education are regarded as second-class choices—for those students who are incapable of the financial strain of attending college or incapable of the mental strain involved in college preparation. Industrial arts and vocational courses are thus regarded as inferior to the classical subjects requisite for college admission.

A triple irony is evident here. The first is the disdain of educators for vocational and industrial arts curricula, because they fail to recognize that these subjects can be as intellectually stimulating and just as challenging—and perhaps more rewarding—to students than traditional curricular material.

Why do teachers in the humanities and social sciences look down upon those concerned with the trades, skills, and occupations which occupy so much of man's time and energy and which have been the chief medium of his material advance throughout the centuries? The reason, I suppose, is that much of our schooling today—from elementary education to graduate school—derives from the classical world of learning. Classical education is book-centered and word oriented: it looks down upon people who make and work with tools, an anachronistic social attitude deriving from antiquity when slaves performed the menial tasks of society. Those in the liberal disciplines have an almost morbid preoccupation with the printed word, and they have tried to make all students, no matter their backgrounds and interests, share their predilections. Yet they do not regard as intellectually inferior the work of anthropologists and archaeologists, who, looking at prehistoric or primitive cul-

tures, find that much can be learned from the articles fashioned by human hands and which are not derived from a written culture. Much of the creative expression of civilization lies in its artifacts—in its structures, its tools, its paraphernalia of daily life, its organization of its productive and distributive functions—as well as its poetry, literature, and politics. The artifacts of our contemporary technological civilization may not appeal to some, but they represent the sensory, manipulatory, and aesthetic expression and experience of our own time. Are they any less worthy of study, understanding, and appreciation than the artifacts of long-dead civilizations or the masks of primitive African tribes?

The humanistic disdain for our man-made world is founded upon false psychological and sociological premises. An advancing technology requires just as much in the way of human ingenuity, imagination, creativity, and sensitivity as do achievements in literature, art, and the other accouterments of high culture. Technologists express themselves in steel, concrete, glass, and electric circuitry; is that any less noble than expression through words, music, or painting?

The second irony is that, despite the college “bias” which results in the rejection of industrial arts and vocational training in the secondary schools, parents and students turn to the colleges for exactly the same thing. That is, they expect the colleges to provide training for technical careers—of the more prestigious type. Some kinds of professional technical education are looked upon as more prestigious, more lucrative, and more personally satisfying than others. Our entertainment media reinforce the stereotypes: the working man is an “Archie Bunker” while the more glamorous technical callings are pursued by handsome “Young Interns” or by the suave “Marcus Welby, M.D.” Is it any wonder that students opt for college?

Then the third irony asserts itself. Once in college most students are taken aback to discover two things. First, they have set unrealistic job goals for themselves—the attrition rate at even our best engineering schools approaches 25%, and the percentage of would-be pre-medical students who fail to achieve admission to medical schools is even higher. Second, the students learn that their college education—molded along traditional lines by the same forces of classical education which

control elementary and secondary school curricula—has no connection with the “real” world. Except in professional schools such as engineering, medicine, business, and law, the students find that higher education does little to prepare them for earning a living.

But, it will be properly argued, earning a living is not the purpose of a liberal arts education. True, but contemporary liberal arts education does little to prepare its students for learning to live. For little attempt is made in our liberal arts curricula to come to grips with the realities of the structure and operation of contemporary industrial society. Some of our brightest students might rebel against that society, but they rebel also against an education which takes such little note of the social the technological forces which have reshaped society during the past two centuries.

Dr. Gordon T. Bowden, Director of Education Relations at AT&T, finds a “mismatch” between the world of learning and the world of work: Our colleges are filled with students who expect to find jobs that do not exist, while at the same time our great American industries are unable to find the skilled technical personnel which are essential for our industrial economy. We are educating people for jobs that do not exist, and we are not educating them for the jobs that do exist—or for those manpower needs which will arise in the future of our swiftly changing technological order.

The fact is that neither our universities nor our secondary schools are preparing our young people for the world of life. College students find their education irrelevant. And high school students drop out in unprecedented numbers, while those who stay in receive a diploma that represents attendance—not learning achievement. The students are obviously “turned off” by traditional curricula, whether in high school or college.

Some educators attempt to gloss over the number of drop-outs—now approaching 30% in our high schools—by pointing out that there was also a high percentage of high-school drop-outs back in the 19th century. True, but the students who dropped out in the 19th century did so in order to enter the world of work; the job opportunities available to them seemed more attractive or more necessary than a high school diploma. But today’s dropouts do not find a job. Despite a total unem-

ployment rate in the neighborhood of 5%, almost 20% of our young people—those between 16 and 22—are unemployed; even more critical is the fact that the proportion of unemployed Negro youth in that same age group is reaching 30%. They have not dropped out of high school in order to take jobs; their lack of training means that there are no jobs available for them. These youth are not only dropping out of school, they are dropping out of society!

While willing to admit that the social environment plays a large role in the dropout rate, I claim that much of the blame rests upon the traditional curricular emphasis in our educational system—and this includes universities as well as secondary schools. We are failing to impart to our students the nature, meaning, and importance of our industrial system, and we are failing to show our students a viable way of participating in constructive fashion in that industrial system. Instead, many academicians are engaged in castigating modern technology, blaming it for all the ills of modern society. Granted that we have had abuses and misuses of technology which have helped bring about the deterioration of our environment, the spoliation of the countryside, the rot of our cities, and the downgrading of many aspects of the quality of life. Yet the resolution of many of these problems can only be accomplished through a greater technological effort on our part, through applying more sophisticated technology for socially beneficial purposes.

The cure for “bad” technology is not a retreat from the contemporary industrial order but a participatory technology which will prevent technical applications from being used only to benefit narrow interests. The cure for the dropouts from both college and high school is to make college and high school education more meaningful. The cure for the mismatch between the educational preparation of our students and the needs of the world(s) of work is a new approach to education which will provide students both with the grounding for employable skills and with the necessary cultural preparation for life in a democratic industrial society.

\* \* \*

This does not mean that I subscribe to the singular emphasis given “career education” in 1971-72 by Commissioner

Sidney P. Marland, Jr. of the United States Office of Education. Career education is certainly a major function of our schools, but it is not the sole function. Career education is part of the total educational experience, but the whole is greater than this one part.

Just as important as preparing certain students for specific occupational roles in society is teaching all students the nature of the industrial system, and the role which they might play in our technological society. From the earliest grades on through graduate school, students should be introduced, in increasing levels of sophistication, to the functioning, operation, and structure of our industrial society. Students will not be satisfied with an education which is exclusively job-oriented; they must know how that job fits into a larger social context and ministers to human values.

Industrial arts and vocational education should not be construed as alternatives to traditional academic education, but rather as interdependent and mutually reinforcing types of education to which all students should be subjected no matter their career goals. Society cannot function without people to perform the various production, distribution, service, communication, and many other tasks necessary for a complex urbanized and industrialized society. But life and society are made up of more than occupational tasks.

Giving an industrial orientation is not the same as narrow occupational training. Students must learn about our contemporary industrialized society, they must see some relevance between their formal school studies and the world of work, they must learn about the dynamic interplay between technology and society which is characteristic of the present and of the future in which they will live, and they must widen their horizons and options. This approach is necessary for all students, not only those who will be finishing their formal schooling at the high school level.

It is this kind of broader educational approach with which industrial arts educators have been experimenting during the past few years. They have done much to show students the role and value of technology in human history. Since so many of our students are "turned off" by the emphasis on the printed word in our traditional schooling, industrial arts educators are "turning them on" by showing them other facets of human ex-

pression and by enabling them to understand and to participate meaningfully in our industrial society.

\* \* \*

Industrial arts is perhaps better adapted than any other educational area to provide youngsters with orientation for the modern world. It can give them a broad understanding of industrial society, tell them of the opportunities for employment, provide them with basic skills useful for a wide area of job possibilities, and make them cognizant of the positive contributions which they can make to society by constructive participation in the world of work.

In our society of high technology, "know-how" is the most valuable commodity; human resources are our nation's greatest asset. If industrial arts educators can impart basic technical know-how while teaching the students of the broader context of the industrial society in which that know-how is to be applied, they can provide a purposeful education to many students who are now puzzled, confused, and uncertain because of the failure of our educational system to provide them with realistic life goals and realistic means to achieve these goals.

Finally, you will note that throughout this chapter I have linked together industrial arts and vocational (industrial) education. This was done, not through ignorance of the distinctions between the two, but because I believe that they share similar problems and have a common mission. Both are disregarded or downgraded by educators in other fields. Vocational education is considered as a dumping ground for the inept student; industrial arts courses are regarded as "recesses" or respites from true study by students and faculty from other disciplines. And both vocational and industrial arts education must retread themselves to meet new and challenging needs.

The fact is that the public—and this includes local and state boards of education, state legislators, and others who have a voice in educational matters—fail to recognize the distinction between industrial arts and vocational (industrial) education. An analog exists in the situation between scientists and engineers. While *they* recognize the distinctions between themselves, the general public does not. Engineering work and achievements are frequently comprehended under the term

“science.” And the fact is, of course, that science and engineering do come together in many areas of endeavor, and that scientists are acting as engineers when engaged on particular projects, while engineers sometimes do basic scientific work in pursuit of their technical goals.

We should recognize that the complexity of modern American industrial society and its educational needs demands some overlap between the goals and methods of vocational industrial and industrial arts education—and that hair-splitting distinctions and institutional differences should not stand in the way of their joint contribution to our education and to society. Although industrial arts and industrial vocational educators might come from different educational backgrounds, work with different students, and employ different methods in achieving different goals, in some areas their interests, methods, and goals merge. Instead of recoiling in horror from this prospect, both should recognize that much is to be gained from cooperation and not allow internicine warfare or prideful distinctions to make them lose sight of their larger educational mission.

Both have significant roles to play in our country's future, for we are faced with the challenge of intellectual Luddites and prophets of gloom and doom who wish to turn our society away from technological advance. Yet the real problems which will face our students as they live in the 21st century are problems which require technical expertise as well as comprehension of the role which advancing technology can play in satisfying the wants and needs of a growing world population. Such problems cannot be solved by wringing our hands in despair and calling for the backward march of history.

Industrial arts teachers have recently learned that the major justification for industrial arts education lies not in the specific training in technical skills which it imparts, but rather in the attitude which it instills and in the understanding which it engenders toward the tools, processes, techniques, machines and organization of our complex industrial society. Even before Charles Silberman wrote about “the crisis in the classroom” industrial educators seem to have anticipated his advice: “Students need to learn far more than just the basic skills. Children who have just started school may still be in the labor force in the year 2030. For them, nothing could be more wildly im-

practical than an education designed to prepare them for specific vocations or professions or to facilitate their adjustment to the world as it is. To be practical, an education should prepare a man for work that doesn't yet exist and whose nature cannot be imagined."

I believe that this moral task of industrial arts educators will probably be more important than any individual skills which they can teach their students. True, industrial arts educators will continue to develop curricula structured around manufacturing, construction, communication, power, and transportation industries—as they have increasingly been doing during the past few years. Furthermore, they will undoubtedly respond to the need for new environmental or ecological technologies, where these can point to direct response in meeting immediate and specific and practical social needs. They can be a truly positive force in the new participatory technology which is coming into being.

This does not mean that industrial arts educators, any more than the rest of us, will provide the solutions to all the world's problems. We shall have to cope with environmental blight and ecological difficulties as inevitable and continuing consequences of industrial advance. But it is better to cope with the problems than to run away from them, to deal with them rather than to ignore them.

Ours is a society of so-called "high" technology. Despite occasional or cyclic economic turndowns, such a society requires more and more highly trained, technical personnel than previous forms of cultural organization. We may be no more happy nor more secure than our ancestors, but ours is an exciting age in which to live, and we must prepare our students to live in a world of continuous and rapid change. It is the business of the future, said Alfred North Whitehead, to be dangerous. But we can accept the risks with composure and confidence if we set ourselves to the task of educating our future citizens to understand the social forces accompanying technological change and to play a meaningful part in the technological process itself. And, to assist us in the performance of this noble task, we must increasingly turn toward educators in the industrial arts.

## CHAPTER TWO

# Major Societal Forces Affecting Schools in the 70's

*Deborah Partridge Wolfe  
Professor of Education  
Queens College of the City  
College of New York*

### CULTURE—ITS INFLUENCE UPON EDUCATIONAL OBJECTIVES

Anthropologists, sociologists, and psychologists have demonstrated the powerful influence of a culture as a dominant controlling educational force. They have defined "culture" as "the accumulated experience of a group"; including psychological as well as material aspects or traits. Each culture or society taken in its totality has its distinctive traits which individualize and differentiate it from all others. They have indicated that culture is "learned" behavior; it is distinctly human and thus human nature is essentially "culture" nature.

All cultures are relatively organic. Thus, inner relationship between the social institutions, mores, folkways, types of personalities produced within the culture may be seen. In a highly complex culture such as ours, in which the advances of science, invention and technology are everywhere evident, this organic relationship is not so thoroughly maintained and certain areas of the culture lag behind and conflict with other areas. Thus, the task of education as a creative social force becomes one of analyzing, evaluating, integrating and (we hope) of redirecting the culture. Our school programs can only be intelligently built as we are intelligent about traditions, the trends, the emerging condition of American culture.

A study of history reveals the gradual and continuous change in cultural patterns. No culture appears and remains full grown like Juno fresh from her father's forehead, but each is the product of a long period of gestation and must look toward certain alteration. Thus, the school's curriculum must likewise develop. This is equally true of industrial arts as it is in any area of the curriculum. It is for this reason that it seems necessary for us to look very carefully at the major societal forces to which the school should direct its attention, with special emphasis upon those areas of human life which affect us in the 70's.

### **THE SEVEN P'S OF THE 70'S FACING THE INDUSTRIAL EDUCATOR**

Many books have been written about the nature of the 70's and the problems that we face as well as the many and exciting challenges that have been made possible. There has been little uniformity reached by the varying authors who have attempted to describe the period in which we are living. Each author tends to emphasize those aspects of our society with which he is most familiar or has greatest interest. However, even a cursory examination of the literature of the field would indicate that there are some general areas which cannot be overlooked as we study the nature of our changing society and the problems faced by educators who must plan new curriculums in order to keep pace with these changes. I have chosen to use the term "The Seven P's" in order to help us remember some of these major issues which we face. Let us look at these problems:

#### **1. Population Control**

What is the population picture? Where are we now? What are the projections? Presently, there are 3.5 billion in the world. What is startling and frightening is to realize that whereas it has taken all human existence (estimated from 2 to 5 million years) to achieve this level, it will take only the next 30 years to double the figure to 7 billion people. It is this geometric doubling that is compounding the problem. It has been estimated that the human population at 6000 B.C. was about 5 million people—taking perhaps a million years to double. By 1650 A.D. there were a one-half billion people, and it had taken about 1000 years to double. It reached a billion people around 1850, doubling in some 200

years. It took only 80 years for the next doubling, with a population of 2 billion in 1930. The next doubling to 4 billion will be reached early in the 1970 decade at the rate of 40 years. The present doubling time seems to be about 37 years. That's quite a reduction in doubling time: 1,000,000 years, 1,000 years, 200 years, 80 years, and 40 years.

Paul Ehrlich has referred to the problem as "The Population Bomb." Too many people with too little food, on a dying planet. About 3 1/2 billion people today swarm the earth, 2 billion of these are poorly fed—undernourished, malnourished, or starving. Within this decade—unless the excess of birth over death is radically reduced, this world is in for a major famine. If we continue to lower the death rate and do not radically curb the birth rate within this decade, you and I will see millions starving each day. Neither the conscience of mankind nor the practicalities of international politics and warfare will permit the ten nations now producing more food than they can eat to survive peacefully in that day when the streets of 100 other nations are choked with hunger riots. The population bomb is ticking.

A biology professor once dramatized the explosiveness of this doubling process by presenting this problem to his class: if a bacteria which divides once every hour were placed in a test tube to begin the multiplying process, and the test tube became full at exactly the beginning of the 30th day—at what time was the test tube half-full? The students were amazed to find the answer to be the 23rd hour of the 29th day—half-full only one hour away from the completed process which took a total of 29 days or 696 hours. No wonder our duplicating population startles us. Particularly when the "test tube" of the earth is already full to overflowing.

In the last stages it comes upon us very suddenly and swiftly. Ehrlich would remind us as we look at this problem again by saying,

Nothing could be more misleading to our children than our present affluent society. They will inherit a totally different world, a world in which the standard politics and economics of the 1960's are dead. As the most powerful nation in the world today, and its largest consumer, the United States cannot stand isolated. We are today involved in the events leading to famine; tomorrow we may be destroyed by its consequences.

We cannot delay looking at this tremendously challenging problem of population increase.

This problem is not just an American problem, as we well know, but a worldwide problem. Let us compare the United States to India, for example. We have 203 million people, whereas India has 540 million on much less land than we have in the United States. But let us look at the impact of people on land.

The average Indian eats his daily few cups of rice, draws his buckets of water from the communal well, and sleeps in a mud hut. In his daily rounds to gather cow dung to burn to cook his rice and warm his feet, his contribution to the destruction of the land is minimal.

An American, on the other hand, is destroying the earth from the moment he is born. He destroys the large piece of land upon which he builds his sprawling home, double garage and driveway. He will add his share to the 143 million tons of smoke and fumes, 7 million junked cars, 20 million tons of paper, 48 billion cans, and 26 billion bottles the environment must absorb each year. In his lifetime, he will personally pollute 3 million gallons of water, and industry and agriculture will use ten times this much water in his behalf. He will also use 21 gallons of leaded gasoline containing boron, drink 28 thousand pounds of milk, and eat 10 thousand pounds of meat. The latter is squandered in a life pattern unknown to Asians. The average Indian citizen, whose fecal material goes back to the land, has but a minute fraction of the destructive effect on the land that the affluent American does.

The demands on water and land for our growing population are expected to be far greater than the supply available in the year 2000. Said Wayne H. Davis, biologist at the University of Kentucky,

We are destroying our land at the rate of over a million acres a year. We now have only 2.6 agricultural acres per person. By 1975 this will be cut to 2.2, the critical point for the maintenance of what we consider a decent diet, and by the year 2000 we might expect to have 1.2.

It is for that reason then that we see the great necessity for understanding the population explosion and its many ramifications for the future which we now hold out to the present college generations is one in which their children will, at best, lead

miserable lives and die young. Hunger, the principal killer of man, threatens to become the killer of mankind.

## 2. Pollution

One cannot look at the problems of extended population control with this utilization of the land and its resources without recognizing that the second major *P* in our society is *pollution*. A great deal has been said recently about this and the 92nd Congress of the United States finally gave serious consideration to the importance of control of our environment by passing some major legislation. However, Rachel Carson and many other biologists have been warning us for many years about the importance of pollution and the monumental waste of our resources. We had to wait until the stench of the Hudson became so unbearable that we really gave major consideration to the problems of pollution. Not only is our water polluted but our air and our land.

So important has this issue become that the first worldwide gathering ever held on the subject of the international environment brought policy makers from 113 nations to Stockholm for 12 days in June of 1972. They came together under the auspices of the United Nations to draw a blueprint to protect man and his habitat. The conference theme was "Only One Earth." This in itself indicated that all living and inanimate things amongst which man dwells are part of a single interdependent system and man has no place else to turn if he despoils his own surroundings through abuse. The conference in its declarations called attention to the major concern that we face and expressed its aim thusly: "to inspire and guide the peoples of the world in the preservation and enhancement of the human environment."

This international political consensus was adopted by acclamation. Though not legally binding on the nations that sign it, it may in time become the basis for the development of treaties codifying some or all of its provisions. Among the 26 principles expressed in the declaration were these: "Man has the right to an environment of quality and a responsibility to protect and improve that environment for future generations," and "Governments have the right to exploit their own resources and develop their own environmental policies but they also have the responsibility to assure that activities within their national jurisdictions

do not cause damage to the environments of other countries or areas." Among the principles of the declaration was emphasis upon the importance of planning and management of the resources of nature. There is no doubt that the United Nations in calling this conference felt it tremendously important to express concern that man and his environment must be spared the effects of nuclear weapons and of all other means of mass destruction.

The conference is particularly important to us as we look at the problem of pollution since it listed 109 recommendations for specific steps that must be taken in order to implement the principles of the declarations that had been expressed. Again, among this vast list of suggestions appeared such actions as: earth watch, new procedures for identifying pollutants, safety limits for common air and water contaminants, restrictions on ocean dumping, international registry of chemicals, and a vast itemization of individual activities and citizen responsibilities. Yes, pollution will destroy us unless we learn to utilize our increased knowledge and understanding of our technological society to provide more experiences and a richer life rather than destroying that which we have found. What is at stake is the survival of life in human form. Solutions to our environmental crisis demand a new and broader understanding of our decisions involving commitment and action.

### 3. Poverty

It is unbelievable that at a time when our society seems to be most productive, technologically skilled, and intellectually expanding that we must list among our *P's* that of poverty. At the time of the so-called agricultural revolution, security was reduced and the carrying capacity of the land and the society was increased. Thus, the pressure of overpopulation in a hunting territory was, by a cultural solution, turned into the pressures of insecurity of small farming communities. Then, through the years and countries, distribution facilities were improved and new ways of food storage invented. Although, and apparently because of prejudice and fear, we do not use the most effective method we have for storing food (a radiation process), food storage as a purely technical matter is not the point of greatest difficulty today. Technical problems remain, but the western world is good at solving technical problems.

However, advances in food production and food storage do not extend to food distribution because food distribution is done through the medium of money, and in the program of money you still have to program social status. That is, in our scheme for food distribution, we program a number of factors other than the amount of food and the amount of hunger. It is akin to the need in the Japanese language to program in verb-ending the status rank of the addressee. In today's world, these extraneous factors in monetary programming have to do with status and rank.

Whereas famine is the scourge of a peasantry, chronic malnutrition is the scourge of the civilized poor. Famine is caused by crop failures and lack of long distance distribution systems. Chronic malnutrition may occur anywhere, caused by lack of protein or certain vitamins in the diet yet unavailable to many people, but it is certainly rampant in situations where poor and hungry people must choose between spending scarce money for "good" food or for other things that they feel they need as badly. Poverty does not merely cause malnutrition—it positively encourages it. And so the problem of malnutrition and poverty lay side by side in an affluent society.

Almost ten years ago when President Johnson declared all-out war on poverty in America, he called attention to the real national need for eliminating this major problem. We believe that there will always be some Americans who are better off than others but it need not follow that "the poor" are always with us. In the United States today we can see on the horizon a society of abundance, freeing people of much of the misery and degradation that have been the age-old fate of man. Steadily rising productivity, together with an improving network of private and social insurance and assistance has been eroding mass poverty in America, but the process is far too slow. It is high time to redouble and to concentrate our efforts to eliminate poverty.

Poverty is costly, not only to the poor but to the whole society. Its ugly byproducts include ignorance, disease, delinquency, crime, irresponsibility, immorality, indifference. None of these social evils and hazards will, of course, disappear with only the elimination of poverty. But their severity will be markedly reduced. Poverty is no purely private or local concern. It is a social, national and, indeed, even international problem.

But the overriding objective is to improve the quality of life of individual human beings. For poverty deprives the individual not only of material comforts but of human dignity and fulfillment. Poverty is rarely a builder of character.

The poor inhabit a world scarcely recognizable, and rarely recognized, by the majority of their fellow Americans. It is a world apart, whose inhabitants are isolated from the mainstream of American life and alienated from its values. It is a world where Americans are literally concerned with day to day survival—a roof over their heads, where the next meal is coming from. It is a world where a minor illness is a major tragedy, where pride and privacy must be sacrificed to get help, where honesty can become a luxury, an ambition a myth. Worst of all, the poverty of the fathers is visited upon the children, and our studies of welfare cases indicate over and over again that parents of poverty beget children of poverty.

Equality of opportunity is the American dream, and universal education, our noblest pledge to realize it. But, for the children of the poor, education is the handicap race; many are too ill prepared and ill motivated at home to learn at school. And many communities lengthen the handicap by providing the worse schooling for those who need the best. Our nation's most precious resource is its people. We pay twice for poverty; once in the production lost in wasted human potential, again in the resources diverted to coping with poverty's social byproducts. Humanity compels our action, but it is sound economics as well. And so in launching the war against poverty the Council of Economic Advisors reported in 1964 that:

One-fifth of our families and nearly one-fifth of our total population were poor.

Of the poor, 22% were nonwhite; and nearly one-half of all nonwhites lived in poverty.

The heads of over 60% of all poor families had only grade school education.

Even among those denied opportunity by discrimination, education significantly raised the chance of escape from poverty, but education does not remove the effects of discrimination. When nonwhites were compared with whites at the same level of education, nonwhites were poor about twice as often.

One-third of all poor families were headed by a person over 65 and almost one-half of families headed by such a person were poor.

Of the poor, 54% live in cities, 16% on farms, 30% as rural nonfarm residents.

Over 40% of all farm families were poor. More than 80% of nonwhite farmers lived in poverty.

Less than half of the poor were in the South.

One-quarter of poor families were headed by a woman, but nearly one-half of all families headed by a woman were poor.

When a family and its head had several characteristics frequently associated with poverty, chances of being poor were particularly high: a family headed by a young nonwhite woman with less than an eighth grade education was poor in 94 out of 100 cases. Even if she were white, the chances were 85 out of 100 that she and her children were poor.

Even though the 1970 census reported that there had been an increase in the income of Americans and that blacks had nearly doubled their incomes in the last decade, there were still millions living in America in 1970 who were below the poverty level as measured by the Office of Economic Opportunity. Again, in fact, since we have noted that certain geographical areas of our country and ethnic groups tend to suffer most heavily from poverty, in 1970 in the South there was still a decidedly lower per capita income than in other parts of the United States. Throughout the country black families still earned less than two-thirds as much as whites in real terms. And a study of the state-by-state median family income of 1969 revealed quite clearly that such states as Mississippi, South Carolina, Tennessee, South Dakota, New Hampshire, Louisiana and Kentucky, Arkansas and Alabama showed a decidedly lower income than such states as Alaska, California, Connecticut, Delaware, Hawaii, Illinois, Maryland, Massachusetts, Michigan, Nevada, New Jersey and New York. Much can be said about where one lives and to what race one belongs. One of the greatest challenges, therefore, as we face the 70's and recognize the problems that challenge us as we develop our school programs and activities, is the problem of poverty.

#### **4. Persecution and War**

There is some question as to how effectively we may be able to attack the problems of population growth, environmental exhaustion and poverty while, at the same time, we are carrying on a war. The dragging continuance of an undeclared war amid

increasing hopes for peace means general realization that peace in Vietnam may mean peace in America, that war in the Mid-East may easily bring war to the West. We recognize the continuance of persecution between people in a multi-ethnic, multi-racial, multi-cultural society. The fear of persecution is reflected not only in the major wars but even indeed in the understanding between people within our country. We are in a time of revolt. Ultimately it is a revolt of THEM AGAINST US. *They* are everyone who does not share our perspective of life and time and how these should be spent. *They* are people with the image of a different Utopia, no matter how vaguely imagined; and our Utopia is not for them. We are not experienced as providers and protectors—though we do both, not as well as we could, but we try. We are viewed as counselors and guides to responsible adulthood, though we try in a bungling and well-intentioned way. We are not experienced as leaders gladly followed to the death in the pursuit of righteous causes in foreign fields. And we see the problem of alienation closely related to the problem of persecution and war.

Erich Fromm has discussed the impact of forces in the American social environment on individual mental well-being, a crucial factor in any crisis. He considered the causes for much individual social and national discontent. Fromm's discussion of this discontent also appears to explain the causes of our environmental problems and thus to speak to all of us concerning our earth's deterioration. He suggests that the causes of our environmental problems may be identical to those characterized by massive individual and group discontent in our society. He argues convincingly that "man has lost his central place, he has been made an instrument for the purposes of economic aims, he has been estranged from and has lost the concrete relatedness to his fellowman and to nature, he has ceased to have a meaningful life." In other words, modern man suffers psychological deprivation, and man who is psychologically deprived is ill suited for purposeful decision making in dealing with our environment. Fromm continues in this discussion and defines the implications of this psychological state thusly,

Man regresses to a receptive and marketing orientation and ceases to be productive; . . . he loses his sense of self, becomes dependent on approval,

hence, tends to conform and yet to feel insecure; he is dissatisfied, bored, and anxious, and spends most of his energy in the attempt to compensate for or just to cover up this anxiety. His intelligence is excellent, his reason deteriorates and in view of his technical powers he is seriously endangering the existence of civilization, and even of the human race.

In short, "alienated man may comprehend the environmental crisis without mobilizing commitment to attain ecological balance." This analysis of the alienation and of the mentally debilitating forces in our contemporary society suggests that man's unique evolutionary product, his psychological apparatus which sustain balance between him and his environment, is in great jeopardy and there is indeed a crisis which we must face as we define the societal forces to which the school should direct its attention.

## 5. (Racism) Prejudice

A discussion of the societal forces of 1970 must give some attention to the problem of racism and prejudice. A few years ago, the President of the United States appointed a commission to study the problem in our country. This commission, headed by Otto Kerner published a report on March 1, 1968. In the ensuing year, 700,000 copies of the report were sold. This report unequivocally identified racism as one of the major problems of modern America. In Tom Wicker's introduction to this report of the U.S. Riot Commission, he said,

This report is a picture of one nation, divided. It is a picture that derives its most devastating validity from the fact that it was drawn by representatives of a moderate and responsible establishment. Segregation and poverty have created in the racial ghetto a destructive environment totally unknown to most white Americans. What white Americans have never fully understood but what the Negro can never forget is that the white society is deeply implicated in the ghetto. White institutions created it, white institutions maintain it, and white society condones it.

It is time now to turn with all the purpose at our command to the major unfinished business of this nation. It is time to adopt strategies for action that will produce quick and visible progress. It is time to make good the promises of American democracy to all citizens—urban and rural, white and black, Spanish surname, American Indian, and every minority group. This announcement

was made in 1968, meanwhile what has happened to the ghetto? It has spread to include more territory; but it has not taken in numbers of people at the same rate. Instead whole areas of hard-core slums have become depopulated, given over to rats and the junkies. No new immigrant group could be found for them—no poverty group desperate enough. High vacancy rates have caused the city to become even more blighted and the projection of trends made by the Kerner Report envisioned for 1985 have become true even in 1972 when we find “an America of swollen metropolitan areas, black at the core and white at the fringes, with its problems expanded beyond hope or solution.”

The 1972 Congress ended the 92nd session still arguing on whether to bus children to secure integration of schools so that there could be better understanding of all Americans by each other. There are still, in many cities and communities throughout the United States today, major problems which have as their base the problem of race, the problem of prejudice, the problem of lack of understanding. The new “will” about which the Kerner Report talked in 1968 has not been generated.

But other things have been generated, among them a new self-confidence and pride within the black group and a new fear and hardness within the white. Blacks, for the most part, still want to become a part of the mainstream of American life. But they want it on equal terms. What went wrong?

The Commission's recommendations embraced three basic principles:

1. To mount programs on a scale equal to the dimensions of the problem.
2. To aim these programs for high impact in the immediate future in order to close the gap between promise and performance.
3. To undertake new initiative and experiments that can change the system of failure and frustration that now dominates the ghetto and weakens our society.

What has happened four years later? Unfortunately, the Commission on Civil Rights, which has been the means by which and through which these recommendations were to be implemented, is greatly weakened by recent resignations by four of its commissioners. Nothing challenges America and society more than the problem of prejudice. For living as we do, in a multi-ethnic,

multi-cultural nation and world we can no longer sit idly by and give little sincere effort to the removal of prejudice.

I remember discussing America's isolationist policy as a college student. We felt that since we were separated from Europe by 3,000 miles of water and from Asia by even greater distances of water that we need not concern ourselves too drastically with the problems of the peoples of these continents. But no one can sit in the halls of the United Nations and not recognize that the Monroe Doctrine has long outlived its usefulness and the world is indeed one neighborhood. What happens in any part of the globe in terms of interpersonal and intergroup relations affects all of us. The discussion of apartheid in South Africa is as meaningful to those of us in America as to the people who live in Rhodesia and in those parts of the world which geographically border that nation. Traveling in outer space will mean nothing unless we build up closer relationships and understandings between all of the people who live on the planet Earth.

## 6. Protection from Violence

The sixth *P* rose out of the preceding *P*'s—persecution and war, prejudice and racism. Whether customary lethargy and indifference, together with continuing belief in racial caste, has accounted for the slow movement in overcoming prejudice and racism in our country, we shall never really know. A new factor entered the picture with the murders of Martin Luther King, Jr. and Robert F. Kennedy. The nation in general, and most of the official leadership, turned its attention away from the basic problems of racial caste to stare with hypnotized fascination at the specter of violence. Anger stalked the streets and fear gripped the home, and in very short order, the President of the United States appointed a Committee headed by Dr. Milton Eisenhower to look into the causes and prevention of violence and, thus, protection from violence becomes my sixth *P*.

The Eisenhower Report, with its twelve impressive volumes of supporting materials, is the source for our understanding of this major problem faced by every American in every city and hamlet of our country. The Eisenhower Commission said:

When in man's long history, other great civilizations fell, it was less often from external assault than from internal decay. Our own civilization

has shown a remarkable capacity for responding to crisis and for emerging to a high pinnacle of power and achievement, but our most serious challenges to date have been external — the kind this strong and resourceful nation could unite against. While serious external dangers remain, the graver threats today are internal: haphazard urbanization, racial discrimination, disfiguring of the environment, unprecedented interdependence, the dislocation of human identity and motivation created by an affluent society all resulting in a rising tide of individual and group violence.

Even a cursory perusal of a daily newspaper or weekly news magazine, or listening to the daily radio and television news reports, will call attention to the fact that little heed was given to the Eisenhower report, for all about us violence is expanding. Not only in terms of crimes in the street, the skyjacking, murder even at the Olympic games, and other kinds of violence little known in a highly developed civilization, one would need to look anew at the admonition of the Eisenhower Commission when it said:

We believe that the twin objectives of the social order must be to make violence both unnecessary and unrewarding. To make violence unnecessary, our institutions must be capable of providing justice for all who live under them—of giving all a satisfactory stake in the normal life of the community and the nation. To make violence unrewarding, our institutions must be able to control violence when it occurs, and to do so firmly, fairly, and within the law.

Above all, there seems to be little disposition to take up the theme which the Eisenhower Report stressed in following behind the Kerner Report which read:

The way in which we can make the greatest progress toward reducing violence in America is by taking the action necessary to improve the conditions of family and community life for all who live in our cities, and especially for the poor who are concentrated in ghetto slums.

It is indeed sad that the leading newspaper in our nation's capitol each day has a column entitled "Today's Crimes," and there follows a listing of the thefts, of the murders, of the robberies, of the assaults, and other crimes indicating violence in the street.

And yet everywhere there appears to be a disposition to turn away from the causes of violence and the essential effort to correct these causes and to fix attention on the phenomena of violence as something to be repressed. Violence has become like a

disease in our society. Those who would claim that American violence is merely human nature at work in an imperfect society must reconcile the amazing disparities in the incidence of violence as between the United States of America and sister nations. Our homicide rate, for example, is nearly five times that of Canada, nearly nine times that of England and Wales. Is our "human nature" so different, so depraved in comparison?

A phenomenon, not of its essence, violence nevertheless has a way of feeding on itself as do many biological diseases. We have seen it on our campuses; an even better example is found in contemporary France or Japan. Hundreds of campuses in Japan were completely closed down for a major portion of recent years because of student violence, and we need not go very far in the United States to point to incidents of violence perpetuated by those who are paid to keep the law. And thus throughout our land each day, new fears are born as people fear to walk the street, even to attend funerals and church services for fear they will be molested.

Meanwhile, on the larger front, instead of moving aggressively to remove the causes of violence and to build the inclusive society which would make violence unnecessary, we witness an appalling development in the patterns of our cities. Such violence and terrorism is felt throughout the world and so the United Nations, in one of its major committees, has been giving its entire attention to the problem of terrorism as it affects international relations and better understanding throughout the world. No one could look at 1972 without listing this *P* among those to concern us as we list major societal forces affecting the school and its development.

## 7. Pot and Other Drugs

As recently as six or eight months ago, it might have been possible to speak in other than strident tones about the number of young people who were reversing Karl Marx and making opiates the religion of the people. Today, when the drug subculture is rapidly becoming the dominant culture of tomorrow's citizens, humor would be misleading. There is no single easy explanation for the growing use of drugs—from marijuana and other "soft" drugs through the hallucinogens and "speed" to the

“hard” drugs like morphine and heroin. Whatever the reason may be, the fact with which there is no argument is that there has emerged a whole new subculture which threatens to be the culture pattern of the immediate future and which may in the end destroy the culture.

A recent article in the *Reader's Digest* “A New—and Growing—Drug Threat” began: “From a 60-thousand square-mile region of Southeast Asia, a fast-swelling river of heroin is being funneled toward the United States and Europe. Stopping this ominous flow will be a formidable challenge . . .” The article goes on to give an account of U.S. Custom inspectors in Honolulu who spotted a suspicious parcel on its way from Bangkok, Thailand to a man in Chicago. It turned out to contain a leopard skin with two pounds of pure heroin concealed inside the head. Another nine pounds of the drug were found in an already-cleared shipment of skins. The threat continues to grow—not only to those who have been familiar with it for many years, the poor people of the slums, the neglected, and the underprivileged—but more and more to the middle and upperclass, young and old.

Currently, the major source of heroin entering the United States is Turkey. For years, much of that country's legal opium crop was diverted to laboratories in France. Turkey now has agreed to halt all opium growing after this year. But even if the ban is effective, warns John W. Parker, Deputy Chief of Strategic Intelligence of the Bureau of Narcotics and Dangerous Drugs (BNDD), it will make virtually no difference in the amount of heroin coming into the United States unless the flow from Southeast Asia is also stopped.

A recent article in *Time Magazine* is headed “Search and Destroy—the War on Drugs.” As one reads this article and similar ones appearing almost every day in every journal and in almost every paper throughout the country, there are accounts of drugs coming from various parts of the world into the United States; a never-ending flow that cripples more and more people and wastes more and more of our human energy and resources.

The United States war on heroin is only getting underway, and it is not without its critics, who variously contend that it is too little, too late, and that the effort is diffused because some narcotics agents go after marijuana dealers with the same zeal

they apply to the heroin traffic. Barring any unexpected developments—an international agreement for a total ban on the poppy or discovery of insects that attack this plant, or a medical breakthrough on treatment of addiction—the outlook is for protracted war. There will be little deviation from the present U.S. strategy of tough, front-door diplomacy with the countries along the drug supply line and back alley smirking with the traffickers. That strategy will not bring victory in the drug war but even a draw would be a plus—provided that the respite is used to develop a social and educational approach to the problem of addiction.

### SUMMARY

As we look at these seven *P*'s of the 70's: population control, pollution, poverty, persecution and war, prejudice (races, creeds, color, sex, and age), protection from violence and pot and drug abuse, we must see that they are complicated by the technological revolution and the revolution created by the expansion of human knowledge. There is no doubt that the technological revolution has made possible the tremendous expansion of man's capabilities; in fact, one might define technology as the practical techniques, methods, artifacts and systems by means of which man has extended his natural capabilities. Such a definition makes it difficult to differentiate between "technology" and "knowledge." But certainly as we use the term technology and recognize the tremendous changes that have taken place in our society due to technology—cybernetics, computer utilization, development of many machines and instruments to improve communication and understanding—there is no doubt that the school is greatly challenged. The rapidity of this change makes even more complexing the problem before us. For one cannot look at advancing technology without recognizing its effect upon human values and individual growth and development.

The world is living through a tremendous period. The ever-present possibility of nuclear holocaust, however remote, has doubtless had important social and psychological effects. An even more important consequence may be the substitution of limited goals for absolute national objectives, with an associated decline in individual identification with and commitment to the resulting policies.

With increased technical growth and skills, the United States is now in the last stages of conversion from a rural to an urban base. We need but look at the last census to realize that no longer can we think of America as a rural or even semi-rural nation. This has tremendous implications, even repercussions, on the total social structure and on the development of group life in our society. The old social structure of the ethnic neighborhood or the dynastic family has virtually disappeared, possibly a victim of the new freedom and mobility provided by increased mechanization, the automobile and other means of transportation. Many institutions are being challenged as never before; and the Church, the family and other major elements of social life are struggling to maintain their identity, existence and relevance.

Technology has brought with it some tremendous opportunities for education and one cannot discuss the technological revolution without mentioning at least two major impacts that it has had on education. The obvious one, at least that which receives the most attention, concerns the actual use of technology in education, for example, the impact of computers and other audio-visual hardware and software. The second, and in my opinion more significant, are the new requirements which a technological society places on formal education. These two developments create situations both conducive and inimical to the growth of humanness and the recognition that education must never lose sight of its major golden purpose—developing human resources to their fullest possible extent.

The knowledge explosion adds to the complexity of the situation, and knowledge is such a complex multi-dimensional structure that no single number can measure it. The best we can do is to find more or less satisfactory approximations. As culture changes, as technology grows, as new needs are born, knowledge expands. In the last 50 years more discoveries have been made and more knowledge added to accumulated knowledge than in all of the period man lived prior to 1920. The rate of growth of scientific knowledge seems to have accelerated almost from the beginning; this is not surprising as with an increase in knowledge comes an increase in knowledge about how to increase knowledge. The more knowledge there is, the easier it is to add to it—and there are no limits to knowledge. This is the excitement one finds in seeking to discover the truth.

We are challenged as educators to "keep pace with space." The uneven allocation of knowledge-producing and knowledge-applying resources is a source of imbalance and consequent stress in the society. The area most neglected includes problems of crucial importance to individual fulfillment and social well-being. Inequities in access to knowledge and, consequently, in the distribution of opportunity, power, and other benefits outrage the human sense of fair play and lead to smouldering or explosive resentment, as well as deprive society of needed talent. Technological knowledge has extended man's observational, constructive, and destructive capacities more rapidly than it has extended his capacities to understand or to choose among the alternatives open to him. An increase in knowledge relating to human capabilities and human understanding must go hand in hand with an increase in material technology.

All of these challenges direct attention to the need—the demand—that the schools of the 70's, no matter what the subject area, make major educational changes. To list but a few:

First, a change in the organizational structure so that we see school and education as expanding the total life of a man: education from the womb to the tomb.

Secondly, education must be changed to give greater emphasis to individualization of instruction so as to meet more nearly the needs of every learner.

Thirdly, education must utilize more fully large support systems and recognize that the school cannot by itself educate the whole man. It must relate to and work with other agencies in the society that educate and it must do it by managing tremendous instructional resources, information storage and retrieval, multi-media instructional packages, and many other methods that are yet to be discovered.

Fourthly, education must be available to all. Learning centers must be created. The open school and the open university must become a reality.

As more powerful and effective educational systems develop, it is essential that long range objectives of education remain paramount. There must be a constant reevaluation of the needs of society and the ways in which education can meet these needs.

It is obvious, I believe, that no society has ever made heavier demands upon its educational system than America today lays

upon hers. It will be no slight task to fulfill these demands; it will require the Herculean efforts of all Americans who recognize the seriousness of the need and who care enough to speak up about it. I believe that education can be and must be the keystone to the arch of freedom. I have high hopes that the public will become increasingly aware of this need. You, and I, and all America, face a task the size of which and the importance of which must be understood. What the United States will be capable of tomorrow in all areas of her life will depend upon what we do for education today.

And tomorrow is close at hand.

### BIBLIOGRAPHY

1. Bonnay, Charles, "A New and Growing Drug Threat," *Readers Digest*, June 1972, p. 85.
2. Davis, Wayne Harry, *Readings in Human Population Ecology*, Englewood Cliffs, Prentice-Hall, Biological Science Series, 1971.
3. Ehrlich, Paul R., *The Population Bomb*, New York, A Sierra Club/Ballantine Book, 1968, p. XIII.
4. Eisenhower, Milton Stover, *The Rule of Law: An Alternative to Violence*; A Report to the National Commission on the Causes and Prevention of Violence, Aurora Publishers, Inc., Nashville, 1970.
5. Fromm, Erich, *The Sane Society*, New York, Fawcett World Library, 1955.
6. Gallagher, Buell, *The Troubled Campus*, G. Kerry Smith and others, San Francisco, Jossey-Bass, Inc., 1970, p. 10.
7. Hardin, Garrett, *Population, Evolution, and Birth Control*, W. H. Freeman, San Francisco, 1969.
8. Leimas, Carol, *The Message from Stockholm*, Washington, D.C., AAUW leaflet.
9. *Newsweek*, October 23, 1972, p. 48 and *U.S. News and World Report*, October 30, 1972, p. 60.
10. Schendel, Floren F., *Population Control: The Key to Environmental Quality*, Unprinted address delivered at Izaak Walton League State Convention, April 11, 1970, p. 3.
11. "Search and Destroy—The War on Drugs," *Time*, September 4, 1972, p. 22. See also United Nations, *The United Nations and the Fight Against Drug Abuse*, New York United Nations, 1972.
12. Wicker, Tom, "Introduction" of *Report of the National Advisory Commission on Civil Disorders*, New York, A Bantam Book, 1968, p. V.
13. Wolfe, Deborah P., Editor, *Poverty in the United States*, Washington, D.C., U.S. Government Printing Office, 1964, p. 2.

SECTION II

**The Role of the  
American Public High School**

# Secondary Schools in Perspective

*Lester Anderson*  
*Professor of Educational Administration*  
*University of Michigan*

Secondary education in the United States has been referred to throughout its brief history as the "Great Experiment" in education. An experiment implies an effort or plan to accomplish something new or different. In the case of secondary schools in the United States, the experiment has been to accomplish universal education through the years normally included in the secondary schools. This objective was motivated to a great extent by the confidence of the American people in education as a factor crucial to the successful implementation of a democratic society.

The establishment of a system of universal secondary education required the investment of large sums of money to build the schools and to provide the materials needed for mass education. The first 250 years of secondary education in this country were occupied largely in providing such facilities and materials. It was not until the twentieth century, however, that the youth of our country enrolled in our secondary schools in numbers approaching the concept of universal secondary education. In 1889-1890, there were only 359,959 students enrolled in grades 9-12, representing 6.7 per cent of the population 14-17 years of age. By 1968-1969, there were 14,200,000 students enrolled in grades 9-12, representing 94.4 per cent of the population 14-17 years of age. Table 1 presents a summary of the gains in enrollment during the period 1889 to 1970.

**Table 1****Gains in Enrollments in Grades 9-12 in Public and Private Secondary Schools in Relation to Population 14-17 Years of Age**

<i>School Year</i>	<i>Enrollment Grades 9-12</i>		<i>Population 14-17 Years of Age</i>	<i>Per Cent Increase</i>	<i>Per Cent of Population in School</i>
	<i>Number</i>	<i>Per Cent Increase</i>			
1889-1890	359,959		5,354,653		6.7
1899-1900	699,403	94	6,152,231	14	11.4
1900-1910	1,115,398	210	7,220,298	35	15.4
1919-1920	2,500,176	595	7,735,841	44	32.3
1929-1930	4,804,255	1,235	9,341,221	74	51.4
1939-1940	7,123,009	1,879	9,720,419	81	73.3
1949-1950	6,453,009	1,692	8,404,768	58	76.8
1959-1960	9,599,810	2,566	11,154,879	108	86.1
1968-1969	14,200,000	3,844	15,048,000	181	94.4

U.S. Office of Education, "Progress of Public Education in the United States" (Washington: Government Printing Office, 1969).

Although the increase in the number of students enrolled in grades 9-12 during the 1900's is dramatic (from 359,959 to 14,200,000), it is the increase in per cent of the population 14-17 years of age (from 6.7 per cent to 94.4 per cent) which has greatest implication for the curriculum of the secondary school. During the early part of the 1900's, the abilities, interests, and background of the students attending high school were much more alike than is true at the present time. As the per cent of students increased, the range of abilities and interests of pupils also increased dramatically.

A reflection of this change is found in statements from members of the older generations when they say: "Schools today are not like they were when I was a boy." Or, in a similar statement: "Youth in the schools today certainly are different than they used to be." One cannot argue with such comments because the statistics document their accuracy. It also follows, however, that neither can schools of today be like those of yesteryear, if they are to serve the needs of present-day youth and if they are to provide learning experiences appropriate to the abilities and interests of all youth.

Fifty years ago, it was relatively simple to design a curriculum considered to be appropriate to the students in attendance.

Most of the pupils came from homes of the upper and middle classes or from the professional and business community. There was a general acceptance of the idea that the major purpose of the secondary school was to prepare students for entrance to college, with the thought in mind that they would continue in school to become the leaders of our society. If a pupil did not fit the school, he was encouraged to drop out and to enter the world of work. It is not surprising that the drop-out rate from high school during the early to middle 1900's was over the 50 per cent figure.

### ADOPTION OF THE COMPREHENSIVE HIGH SCHOOL

Members of boards of education, as well as the general public, were not satisfied with schools that turned away so many of their children. Aided by professional educators, the citizens of the United States adopted a concept of secondary schools which resulted in the widespread acceptance of the concept of the "comprehensive high school" as the answer to the problems in secondary education; namely, the nagging problem of the drop-out and of providing an appropriate education for *all* youth of secondary school age. The basic concept of the comprehensive high school is that the curriculum should be diverse enough to provide effectively for both the general and specialized needs of students.

In 1918, the Commission on the Reorganization of Secondary Education, although best known for its statement concerning the Cardinal Principles of Education, endorsed the comprehensive high school organization by recommending it as "the standard type of secondary school in the United States." (NEA, 119) Supporters of the comprehensive high school believed that the public school was the one agency that could most successfully resist the forces operating to stratify and divide the society. It was proposed also that it could instill democratic principles as a part of daily living, as well as maintaining the broadest possible variety of opportunities for personal development. Since 1918, support for the comprehensive high school has been voiced by a number of national organizations, including the Educational Policies Commission, National Association of Secondary School Principals, The Committee for the White House Con-

ference on Education, and more recently, by the American Association of School Administrators.

Implementation of the comprehensive high school demanded large schools in order to provide the diversity in program needed to meet the needs of all students. During the period of 1930-1960, thousands of small, single-purpose high schools were discontinued as a result of consolidation or annexation with neighboring schools. For example, the number of local districts declined from 127,244 in 1931-1932 to an estimated 50,000 in 1957-1958, with fewer than half of these districts operating secondary schools.

A major argument against the small high school was its inability to offer a comprehensive curriculum. Typical course offerings in the small high schools included the usual college preparatory subjects, plus music, physical education, and occasionally some art. In many of the rural communities, vocational agriculture and home economics were included with some effort also exerted to offer woodworking and drafting for the boys, as well as typing, bookkeeping and shorthand for the girls. At best, the industrial and vocational courses were introductory in nature and did not prepare students at the level needed for entry into the world of work. Smoker presents an interesting description of many situations of this type:

Not long ago, if you wanted to visit the vocational education classes in a typical American secondary school, you could save some steps by heading directly for the basement. There, in dingy surroundings, a few steps away from the school's boiler room, you'd find a man identified by his fellow faculty members as "the shop teacher" struggling to inspire a group of young men to construct things out of wood and metal with hand tools or antiquated power equipment. The students in those basement rooms, inevitably, consisted of the boys rejected as uncontrollable discipline problems or as non-learners . . . . There was an aura of shame attached to being in vocational education, and everybody understood it—the school staff, the parents, and most of all, the students. (Smoker, p. 1)

To be sure, there were exceptions to situations like the ones described by Smoker, particularly in larger cities which provided a relatively extensive list of courses, but there were many more schools that could not provide such diversity than there were that could do so.

Although the approach to secondary education in the twentieth century generally has been through the concept of the

comprehensive school, many large cities deviated from the idea of a single school to provide for the specialized needs of all students, particularly in the areas of vocational and technical education. As a result, a number of vocational and/or technical high schools were established to serve youth interested in learning a trade or a vocational skill. The major advantages of such schools were: (1) teachers with specialized skills could be recruited, and (2) costs of equipment for vocational and technical courses did not have to be duplicated in every high school.

A major disadvantage of specialized high schools was the inherent social isolation of students recruited from a segregated system. Rather than having a social melting pot, specialized schools segregated students and prevented the intermingling of all types of students. In addition, specialized high schools frequently became dumping grounds for the drop-outs and rejects of the general-purpose schools. It is unfortunate in many respects that this was the case because it was also true that many of the general-purpose high schools could not, or did not, provide adequately for the vocational and technical skills needed by many students. In any event, the special-purpose schools did not become the dominant pattern for secondary education in the United States, although there continue to be such schools in operation today.

### COMPREHENSIVE HIGH SCHOOL ON TRIAL

The launching of Sputnik I in 1957, marked the beginning of many charges and counter charges in education. The first wave of serious criticism was directed at the effectiveness of the comprehensive high school. During this period, Admiral Hyman Rickover and the Council on Basic Education were particularly outspoken and attacked the appropriateness of providing such diverse course offerings as was the case in the comprehensive high schools. It was claimed that the American high school was not serving the needs of youth adequately and particularly it was neglecting the education of the academically talented student. The concept of the comprehensive high school literally was on trial during this period. The question of whether or not mass education at the secondary level was appropriate, or whether or not a single, academic curriculum was needed was debated at many meetings of professional educators, as well as in the popular news media.

It was during this time that the first of Dr. James B. Conant's studies and reports were made. After visiting a number of comprehensive high schools throughout the United States, Dr. Conant reported that, while the comprehensive high school might be a little ill and running a high fever, it was far from dead. On the other hand, considerable attention was given to the idea that there were some changes that had to be made if the patient was to regain its good health and serve its intended function, namely, providing an appropriate education for all types of individuals within one school. One of the major needs for change was to provide more adequately for individual differences of all students, not only the academically talented which was the major concern of Admiral Rickover and the Council on Basic Education. It was well documented that we had indeed fallen into the trap of imposing the same kind of education on many pupils regardless of their ability or motivation. Rather than having too much diversity in the program of studies, there were many schools that did not have enough diversity.

Another factor which must be considered when analyzing changes in education during the past few years is that we had received much of our direction in schools from statements of objectives aimed at meeting the *Needs of Youth*. Now, suddenly, we were being forced to plan for *Needs of Society* as well. Suddenly, we recognized that we could not afford the luxury of wasted brain power, for national survival was related directly to "trained brains."

A variety of innovations were made aimed at providing a challenging program for the education of the academically talented students. The Advanced Placement Program, in which college level instruction is offered in high school, has grown dramatically. Another approach has been to accelerate subject matter content in which content normally covered in two semesters is intensified and covered in one semester. In some cases, students rather than content, are accelerated through the school program and are admitted to college early. Honors classes, with greater emphasis on independent study, also are used to provide for individual differences in pupils. Grouping of students based on multiple criteria, i.e., ability, achievement, motivation, teacher recommendations, etc., has grown substantially.

Practices such as these are now commonplace, but these practices also have triggered other curriculum innovations, par-

ticularly in the scope and sequence of the curriculum. One of the most notable effects has been the pushing down into the junior high and elementary schools subject matter formerly reserved for the high school. Illustrations of this are the introduction of algebra in grades seven and eight, biology in grade nine, and foreign languages in the elementary grades.

In addition to the change in scope and sequence within the schools, there also has been an accompanying revolution within the content itself. Certainly the field of mathematics is characteristic of a new content. Both elementary and secondary school teachers have felt the impact of this and the resulting need for retraining in mathematics. A change in methodology has been particularly dramatic in the teaching of foreign languages. Increasingly, teachers are using the aural-oral approach, with the emphasis on oral communication rather than limiting knowledge in foreign languages to a reading and grammatical approach.

National legislation resulting in the passage of the National Defense Education Act, 1958; the Vocational Education Acts of 1965 and 1968; the Economic Opportunities Act; the establishment of the National Science Foundation; these plus a series of other federal programs, have given considerable emphasis to the improvement of equipment for the teaching of science and mathematics, support of research, the development of guidance services, establishment of compensatory programs, and improvement in a number of school programs, including industrial and vocational education.

Effects of automation also are catching up with schools. Teaching machines, language laboratories, programmed learning, television, and a variety of other aides to learning are being utilized with a rapidly increasing frequency. It is still too early to assess the total impact of such technical developments on teaching and learning, but this might well become one of the biggest developments in education for many years.

The National Association of Secondary School Principals has provided considerable stimulation and leadership in trying out different practices in the utilization of teaching staffs. Team teaching, with its emphasis on utilizing specialized talents of teachers, is being tried in many schools. Included in the proposals for different patterns of staff utilization is the use of teacher aides, interns, and various levels of teacher ranks as part of teaching teams. Closely allied with changes in staff

utilization is the emphasis on instructional groups in a variety of sizes, i.e., large groups, small groups, and independent study.

A more recent concern of the nation's schools has been with the inadequacy of provisions for the disadvantaged in abilities and special interests all along the line.

Although the dramatic changes in the secondary schools during the 1960's were aimed at improving programs for academically talented students and for up-dating subject matter fields, the criticisms and concerns for the welfare of all youth have opened up new vistas for so-called non-academic subjects as well.

It appears as though the 1970s will be a period in which more meaningful programs for employment-bound youth will be implemented. We are beginning to take seriously the fact that students who drop out of school or who complete their formal education with high school graduation may need quite a different educational diet than they have had in the past. Although many graduates from high school do not enter college, the majority of secondary school students participate in a college preparatory program. Using the state of Ohio as an example, its labor force is distributed as follows:

Craftsmen, foremen, and kindred workers .....	16 %
Skilled operators and kindred workers .....	22 %
Service workers .....	11 %
Unskilled workers .....	5 %
<i>Agriculture</i>	
Managers and operators .....	3 %
Farm labor .....	1 %
Sales workers .....	8 %
Clerical and kindred workers .....	15 %
Managers and proprietors .....	8 %
Professional and technical workers .....	11 %

In preparing to enter this labor force at some future date, the high school students are enrolled in the following types of programs:

College preparation—general .....	77.2%
Occupational preparation .....	22.8%
Clerical office practice .....	13.1%
Trade and industrial .....	3.7%
Agriculture .....	2.1%
Vocational office practice .....	1.7%
Home economics, job training .....	0.1%

So far as the school system is concerned, 77.2 per cent of the students are obtaining a general education which will prepare them for college, but not for work. A technical educational program beyond high school could meet the needs of about 25 per cent of all jobs, and college education in the future will be a prerequisite for about 20 per cent of all jobs. This means that 55 per cent of our youth need vocational education.

Ohio is not conspicuously different from other states . . . . Students, nationwide, are not being prepared for the world of work . . . . We have spent much time, effort, and money in home economics education, preparing the girl to become an effective household manager—but, for a jobless husband. (Rhodes, pp. 18-19)

For most youth, the secondary school is their last experience as full-time students; consequently, their formal preparation for work must come during the high school years if transition from school to work is to be successful. Advocates of vocational education stress the point that work-bound students need at least as much assistance as college-bound students in making the next step in life; indeed, the immediate alternatives available to them are in some respects more complex than is the case for college-bound youth.

### CHANGES IN ORGANIZATIONAL PATTERN

Realizing the seriousness of the problem of providing a program of studies appropriate to all students within a single institution, some educators now claim that the "comprehensive high school" has failed to accomplish its major purpose, i.e., to provide a comprehensive program of studies. What is needed now is to stop defending the comprehensive high school as "the" institution for secondary education and to face up to the real issue, which is to provide a comprehensive program of studies.

Responding to this challenge, many states and individual school districts have undertaken large scale programs with the aid of the federal government. One of the most promising changes in organizational patterns to emerge is the establishment of vocational or skill centers designed to serve an area larger than a single district. This organizational plan has a great advantage over plans which have established separate vocational schools because it provides greater comprehensiveness to the educational programs of individual schools, while at the same time retaining the students' identity with their home,

general-purpose school. Whereas the specialized high school divides students, this organizational change maintains the socializing aspect of the "comprehensive" high school, while at the same time, providing a comprehensive program.

In order for this plan to function effectively, it requires that:

- (1) The attendance area be of sufficient size to insure adequate enrollments;
- (2) Administrative patterns and financial structures be developed on as wide a base as possible.

In order to accomplish this, it is often necessary to cut across or replace existing organizational patterns.

A good description of the area vocational concept is presented by the Michigan Department of Education:

The area vocational and technical concept emphasizes cooperative arrangements between two or more school districts, usually adjacent, or between high schools within large districts for the purpose of operating jointly shared vocational education programs for people in relatively large geographical areas or areas of high population density. The area concept includes, also, post-secondary vocational and technical programs on an area basis through strategically located community colleges.

The area concept is based upon the conviction that all persons should have easy access to quality vocational education programs directed to individual occupational preparation needs, abilities and interests.

The area program serves as a centralized extension of existing vocational programs in participating high schools. Any program for which a single high school has sufficient financial resources and students may be offered in that school. To participate in vocational programs not provided in their home high school, students would be transported to another facility for occupational training.

The area program concept provides that students retain their identity with, receive their general education in, and graduate from, their home high schools.

An area vocational program has the following advantages:

1. It provides for a broader tax base distributed over a larger population than is usually present in a single school district.
2. It avoids unnecessary duplication of equipment, services, and cost which might occur if two or more neighboring districts elected to offer identical or similar training programs.
3. It makes possible a broader range of curriculum offerings and, therefore, a more extensive program of occupational training opportunities.
4. It offers training opportunities to a larger number of persons than is possible in smaller schools serving single communities.

5. The area program concept is the best means through which single school districts lacking sufficient financial resources and/or students can provide adequate vocational education opportunities to enable all youth and adults to develop and maintain satisfactory occupational competence. (Michigan, p. iii)

Implementation of area vocational programs is done through four basic types of organizational patterns: 1) two or more local districts cooperatively operating such programs; 2) the operation of such programs on a county-wide basis; 3) the operation of such programs by two-year community colleges on an area basis; and (4) state-operated and administered schools or centers for such programs.

The specific administrative arrangement by which an area vocational program is provided will be selected undoubtedly on the basis of local conditions and legal provisions of individual states. Any administrative arrangement must harmonize with local conditions; however, the major point to be considered in selecting an administrative plan is the concept of providing an area skill center, not a specialized high school. Establishment of an area skill center to serve general-purpose high schools retains the socialization or melting-pot function which continues to be an essential ingredient in resolving social issues within the United States.

### IMPLICATIONS OF ORGANIZATIONAL CHANGES

Speculation of results in changing basic organizational patterns of education is always hazardous at best; nevertheless, it appears as though we are in the middle of a change so basic in our thinking about secondary education that it demands analysis and planning. To some, it may appear as a minor change when it is proposed that the concern for continuation of a comprehensive high school is no longer the crucial issue when compared to the concern for bringing a comprehensive program of studies into reality. To others, there are major implications in this situation if we take seriously the challenge to provide educational programs appropriate to the needs of all students. Following are some of the implications and/or challenges facing secondary school teachers and administrators.

## Equal Educational Opportunity

More recent interpretations of equal educational opportunity imply that every child has a right to receive an equal opportunity to an education appropriate to his abilities, needs, and interests. It does *not* mean, as some people assume, that every child should receive the *same* educational diet. Schools should *not* be designed to be equal; rather, they need to be unequal and different according to the nature of the community and students served by them.

Implementation of this concept demands even greater diversity in course offerings than we have known previously. Currently, there are a number of special programs for the disadvantaged, special education and/or poverty situations. Similarly, many federally financed programs stress the need for innovation and change. It is suggested that long-term developments will include most of what is considered now as emergency programs in the regular school program. All subject areas, including industrial and vocational education, will need to provide substantial diversity in the scope, sequence, and ability levels of their subject offerings. Local curriculum planners will need to try out various approaches in their efforts to provide the diversity of learning experiences needed to provide appropriate education for all students.

## Emphasis on General Education

Most high schools which we have thought of as comprehensive high schools will be considered as being general purpose high schools with a major emphasis on general education. Provision of specialized education will be provided at the area skill center. Exceptions to this will be very large high schools that have enough students and adequate financial resources to provide a comprehensive program of studies without the assistance of an area center. Certainly, the content and offerings in industrial arts and vocational education are affected by this change.

Industrial arts education will be designed for the general needs of all students, plus some prevocational experiences. It will not be necessary for industrial arts programs to include vocational experiences. It will not be necessary for industrial arts programs to include vocational courses because these will be offered in the area centers. Course offerings in grades 11

and 12 are the ones most likely to be influenced by these developments. It is interesting to speculate on what could be done in grades 11 and 12 for students who are interested in industrial arts for hobbies, home maintenance, exploration of industrial programs, etc., when the industrial arts program is freed from providing vocational skills programs.

It will be necessary also for teachers in the general-purpose high schools to become involved in planning with teachers in the area centers. Sharing of students' time between the local high school and the area center also will require sharing of teachers' time for planning on an area basis, as well as planning for programs in local high schools.

### **Resolution of Social Issues**

Society has placed a heavy burden on the public schools to resolve the conflicts and tensions between people on major social issues. At the time of this writing, the country is involved in debates over the merits or demerits of busing to bring about integration of the races. Busing of students is not the real issue underlying the demonstrations, law suits, and various forms of protestation being practiced. Thousands of students have been bussed from home to school for years, particularly in the rural areas. It is apparent that the issue of racial integration is the real problem. Politicians, and society in general, need an arena in which to resolve such issues, and the public schools are it.

There is a good reason why social issues of this type are related to where a child attends school, namely, the public school is the only place in our society where all kinds of people have an opportunity to associate with one another. If understanding, tolerance, and mutual respect develop from associating with people of different backgrounds, we need to retain the schools as the place where it occurs. All other social and fraternal institutions, including churches, clubs, lodges, etc., usually are selective of their members on some basis, i.e., socio-economic, religious, or racial.

Public schools remain the major source of socializing experiences for all people. The extracurricular activities, school parties, musical groups, athletic teams, student government, as well as the regular classroom, provide the means for implement-

ing social experiences. It is for this reason that preference should be given to supplementing the program of the general-purpose high school with the program of an area skill center rather than establishing separate vocational high schools.

Teachers and administrators of industrial arts need to assume leadership in the problems of socialization, as well as in the area of curriculum and program development. Sensitivity to the social problems will make a difference in how industrial arts and vocational education programs are related.

### REFERENCES

- Michigan Department of Education, *A Position Statement Concerning the Development of Area Vocational and Technical Education Programs in Michigan*. Ann Arbor: State Department of Education, 1967.
- National Education Association, Commission on Reorganization of Secondary Education, *Cardinal Principles of Education*, Bulletin 1918, No. 35. (Reprinted in *The Development of Secondary Education* by Frederick M. Raubinger, Harold G. Rowe, Donald L. Piper and Charles K. West, The Macmillan Company, 1969.)
- Rhodes, James A., *Alternative to a Decadent Society*. Indianapolis: Howard W. Sams and Company, Inc., 1969.
- Smoker, David S., *Vocational Education: Innovations Revolutionize Career Training*. Washington, D.C.: National School Public Relations Association, 1971.

SECTION III

**Senior High School  
Industrial Arts Programs:  
A Study of Careers**

# Industrial Arts and Career Education: Focus on Homogenization

*Douglas Pine  
Research Associate, Industrial Technology Education  
The Ohio State University  
Columbus, Ohio*

## Background of the Problem

The concept of career education is not new to public schools in the United States. Educators have long recognized the need to prepare their students for the world of work. However, studies of the degree to which this objective is being achieved do not encourage the continuing current curricular approaches.

Approximately thirty percent of the students in the United States (President's Commission, 1972) leave school before high school graduation. Some of these drop-outs possess above average intelligence but find no meaning in school because curricula are not designed to meet their needs. Hoyt's (1965) study of high school students notes that many youngsters complete their public school education with little knowledge or skill related to the world of work and the demands that will be placed upon them by our economic system.

Gibbons and Lohner's (1966) findings reveal that a large number of students do not make realistic appraisals of themselves and the world in which they live when making career decisions. Too often, the long range effects of their career decisions are not fully realized. Peters and Hensen's study (1966)

concludes that many pupils are frustrated in their efforts to select courses relevant to their career goals. This situation seems to be attributable, at least in part, to inadequate career information, too little career counseling, and insufficient professional help.

These studies and countless others make it clear that too many youngsters, upon leaving or completing high school, suffer in varying degrees from occupational illiteracy. The world of work is "invisible" to them because they have not been afforded the opportunity to "see it."

### General Problem

Where are our current curricular efforts deficient? An endless number of answers to this question could be gleaned from the literature. However, early in 1971, Commissioner of Education Dr. Sidney P. Marland identified some major deficiencies in our educational system to which he has given priority attention. In an address at the 1971 convention of the National Association of Secondary School Principals in Houston, Commissioner Marland proposed that:

. . . education's most serious failing is its self-induced, voluntary fragmentation, the strong tendency of education's several parts to separate from one another, to divide the entire enterprise against itself. The most grievous example of these intramural class distinctions is . . . the false dichotomy between things academic and things vocational. As a first step, I suggest we dispose of the term vocational education, and adopt the term career education. Every young person in school belongs in that category at some point, whether engaged in preparing to be a surgeon, a brick layer, a mother, or a secretary.

How absurd to suggest that general knowledge for its own sake is somehow superior to *useful* knowledge. 'Pedants sneer at an education that is useful,' Alfred North Whitehead observed. 'But if education is not useful,' he went on to ask, 'What is it?' The answer, of course, is that it is nothing. All education is career education, or should be. And all our efforts as educators must be bent on preparing students either to become properly, usefully employed immediately upon graduation from high school or to go on to further formal education. (Marland, 1971a, p. 5)

Marland points to the need to reshape the educational system to meet the career demands of our complex technological society:

Of those students currently in high school, only three out of 10 will go on

to academic college-level work. One-third of those will drop out before getting a baccalaureate degree. That means that eight out of ten present high school students should be getting occupational training of some sort. But only about two of those eight students are, in fact, getting such training. Consequently, half our high school students, a total of approximately 1,500,000 a year, are being offered what amounts to irrelevant, general educational pap! (Marland, 1971a, p. 7)

However, the major implication from Gribbons and Lohner's findings (1966) indicates that career development is a process that extends over a long period of time. Studies by Slocum and Bowles (1967) and Campbell (1968) clearly show that elementary as well as secondary students have a keen interest in career development and decision-making.

The foregoing findings support the need for carefully articulated programs designed to foster the career development of all youth at all grade levels.

It is flatly necessary to begin to construct a sound, systematized relationship between education and work, a system which will make it standard practice to teach every student about occupations and the economic enterprise, a system that will markedly increase career options open to each individual and enable us to do a better job than we have been doing of meeting the manpower needs of the country. (Marland, 1971a, p. 6)

### **Specific Problem**

Industrial arts has traditionally aligned itself with the practical arts as a part of general education—education that everyone needs. Even the most recently proposed curriculum approaches, such as the American Industry Project, Industrial Arts Curriculum Project, Man and Technology, and the Maryland Plan, make no mention of industrial arts as education for job training. The objective of providing students with salable skills for specific occupations has never been a part of industrial arts education. However, Commissioner Marland proposes that the "hundreds of thousands of pitifully incapable boys and girls who leave our high schools each year . . . are the unfortunate inmates, in most instances, of a curriculum that is neither fish nor fowl, neither truly vocational nor truly academic. We call it general education. I suggest we get rid of it." (1971b, p. 4)

The role of industrial arts as a contributor to the previously established objective of teaching every youngster about occupations and our economic system seems to be in doubt. This would

appear to be particularly true at the high school level. Commissioner Marland has cast further doubt on the role of industrial arts in career education with the following statement:

Specific skills training at the high school level is an important component of the school-based model. I certainly do not believe that general job information of some kind—the old industrial arts and vocational counselor apparatus—produces useful job skills. Under career education it would be the intention that every youth would leave the school system with a marketable skill. (Marland, 1971a, p. 7)

In light of the foregoing statements and developments, the following questions should be paramount in the minds of industrial arts educators with respect to career education in the high school.

1. What is career education?
2. What is the developmental status of the career education concept?
3. Is there compatibility between the objectives of career education and the objectives of high school industrial arts?
4. If there is compatibility between objectives, how should industrial arts contribute to the career education schema at the high school level?
5. What might a high school industrial arts program look like in the context of career education?

## DEVELOPMENTS IN CAREER EDUCATION

### Background

Career education, as a term and as a concept, has been brought to “front-stage” in educational circles since Commissioner Marland “spotlighted” the term in January, 1971. He has subsequently directed the Office of Education research staff to give major emphasis to designing a workable system of career education.

This is certainly not the first time the Office of Education has given priority attention to a particular area or concept of education. In the late 1940's the emphasis was on “life adjustment.” The successful launching of the Russian's Sputnik satellite in 1957 prompted U.S.O.E. to swing its support behind a crash catch-up program in science, mathematics, and guidance for the gifted. During the latter half of the 1960's, countless

federally supported projects for the "disadvantaged" were initiated. However, the positive or negative effects of these programs are difficult to measure. Hard data are usually not available, which leaves doubt in the minds of many people as to the benefits being derived from the huge expenditures for these programs.

In the past, fairly simple matters like changing the high school chemistry curriculum have taken as long as a full decade or more. The obvious question is: What will it take to reorient the entire public school system to the career education concept? The author would reply that the full realization of the goals of career education may be as impossible to reach as is the idea of 100 percent employment of all people seeking jobs in the United States. Even a partial realization of the objectives of career education will take many millions of dollars, millions of man-hours of dedicated and coordinated effort, and something close to a quarter century of developmental work. However, it is difficult to find fault with the notion that all students need to be occupationally literate, and there is no doubt that Commissioner Marland is striving towards this end even though the results won't be known for years.

### **Comprehensive Career Education Model (CCEM)**

Since the major concern of this paper is with high school industrial arts in the context of career education, any further reference to career education will be made in terms of the school-based Comprehensive Career Education Model (CCEM).

The primary responsibility for the development and demonstration of the CCEM has been placed with The Center for Research and Leadership Development in Vocational and Technical Education, an Ohio State University affiliate. Experimental models are being field tested in Mesa, Arizona; Los Angeles; Jefferson County, Colorado; Pontiac, Michigan; Atlanta; and Hackensack, New Jersey.

#### *CCEM Goals*

The following goals have been established for the Comprehensive Career Education Model:

1. Restructure the entire educational program around real life.

2. Integrate academic knowledge and skills with occupational training.
3. Assure that each exiting student will be prepared for further career education or for entry into an occupation.
4. Provide for each student a program relevant to his becoming a self-fulfilled, productive and contributing citizen.
5. Incorporate into the program community resources and non-school educational opportunities. (Requirements, 1971, p. 1)

### *CCEM Matrix*

"In developing the detailed conceptualization of career education, it is imperative to determine the elements of career development that provide for the self-actualization of the student." (Requirements, 1971, p. 2) The elements that appear in Figure 1 were identified and defined by an examination of theories of authorities in the areas of vocational guidance, curriculum development, and human growth and development. Each element represents a theme that is developed in progressive steps throughout the career education program. The full development of these themes by grade 12 produces the element outcomes or terminal student behaviors on the right side of Figure 1.

Since the elements were derived from theory, their inclusiveness must be independently tested. "If it can be shown that such lists [of elements] are restatements of and are thus included within the framework of the element outcomes it is reasonable to conclude that the element list is comprehensive." (Requirements, 1971, p. 8)

Each element in Figure 1 has been analyzed by the CCEM staff and broken down into several sub-elements or themes. Through a horizontal analysis of the matrix, these themes have been structured into units that progressively develop from kindergarten through the twelfth grade. Behavioral objectives for each element at each grade level specify the specific knowledges, skills, and attitudes to be achieved. Outlined experiences and activities provide the means for accomplishing the objectives.

The matrix can also be analyzed vertically within each developmental level. Certain student activities and experiences will affect more than one element. Therefore, developmental materials must be prepared so that consistency is maintained horizontally within elements and vertically between elements.

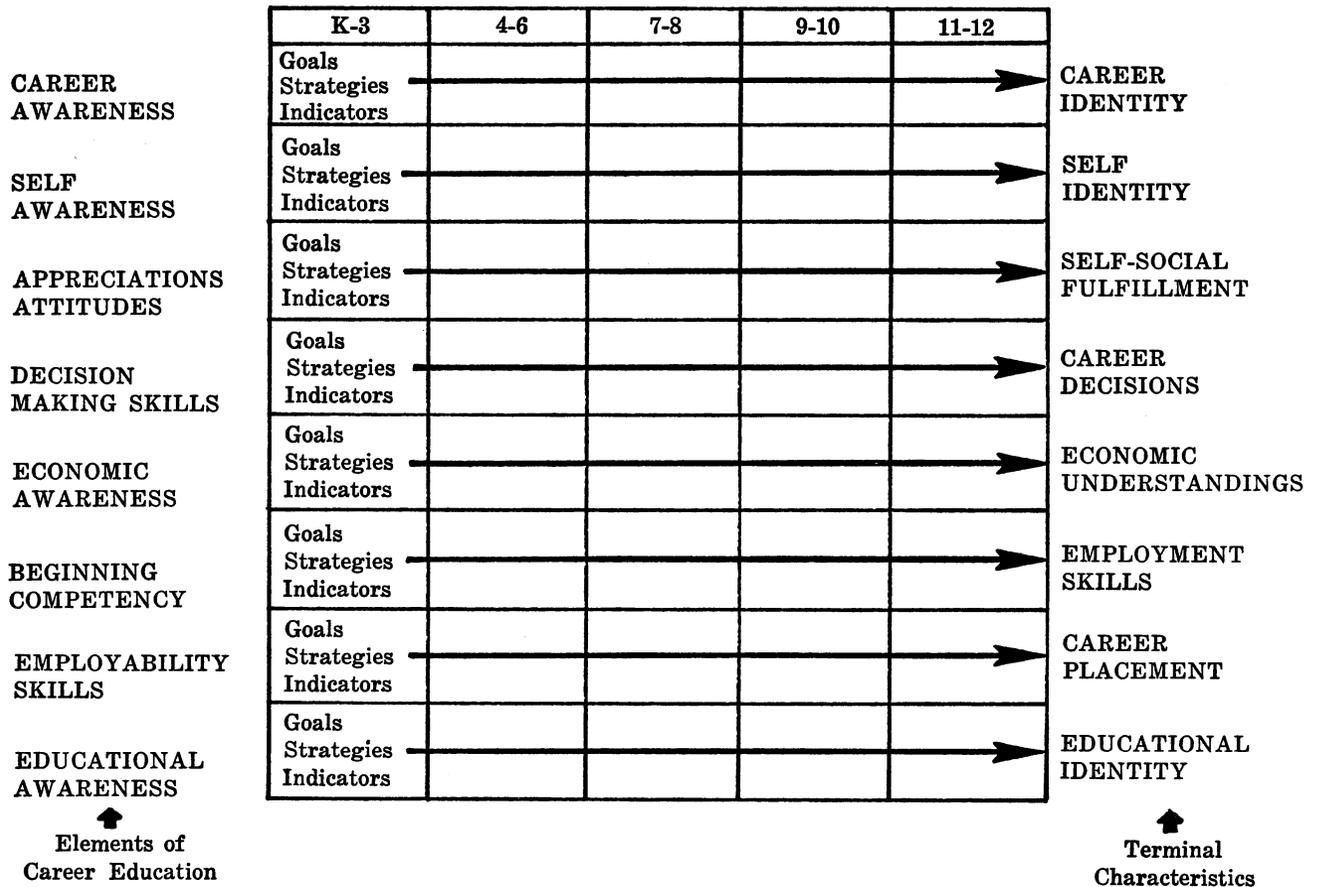


Figure 1. Requirements of the Comprehensive Career Education Model, 1971.

### CCEM Career Information Model

The CCEM has proposed a three-step study of career clusters as shown in Figure 2. A student's career studies would begin with a very broad coverage of the two basic occupational areas of goods and services and become more focused and specialized as he continues his schooling. (Career model, 1972)

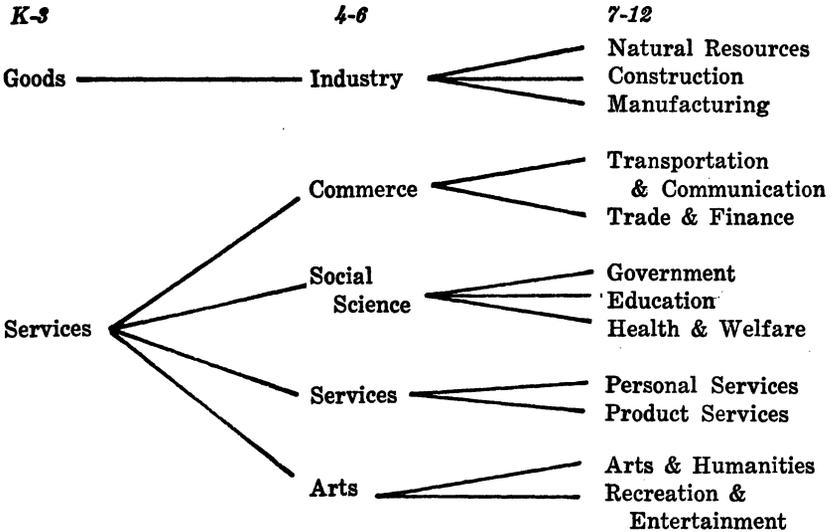
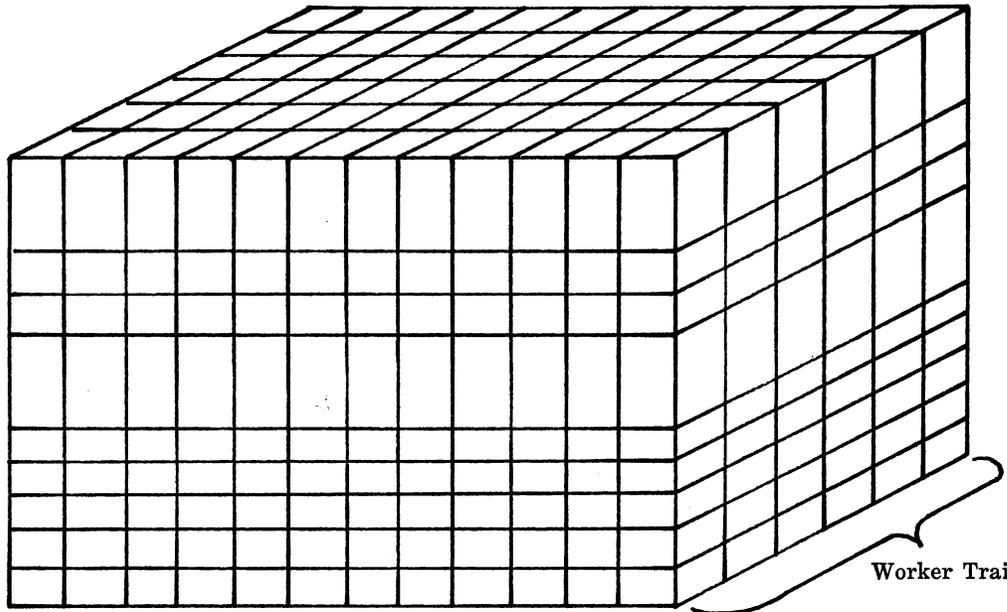


Figure 2. Three-Step Career Clusters Approach.

The CCEM career information model (Career model, 1972) for high school programs appears in Figure 3. The model consists of an information base of job definitions organized into three basic perspectives in which information can be delivered for career education purposes. The vertical perspective consists of the CCEM career clusters. It answers the basic questions: *Where* are the various occupations evident? What are the general career areas *where* all occupations are ultimately subsumed? The horizontal perspective denotes occupational categories based on the commonality of tasks performed by workers as outlined in the *Dictionary of Occupation Titles*. This dimension of the model answers the questions: *How* are the various tasks within each career cluster accomplished? What are the specific occupations? The depth perspective includes worker traits, qualification profiles, general educational background needed, and specific

*D.O.T.  
Occupational  
Divisions*

Professional  
 Technical  
 Managerial  
 Clerical  
 Sales & Service  
 Farming  
 Fisheries  
 Forestry  
 Processing  
 Machine Trades  
 Bench Work  
 Structural  
 Miscellaneous



*CCEM  
Career  
Clusters*

Natural Resources  
 Manufacturing  
 Construction  
 Trade & Finance  
 Transportation &  
 Communication  
 Government  
 Education  
 Health & Welfare  
 Personal Services  
 Product Services  
 Arts & Humanities  
 Recreation &  
 Entertainment

Worker Traits

**Figure 3.  
CCEM  
Career Information Model.**

vocational preparation required. It answers the basic question: *Who performs the different tasks and what is he like?*

The model has been proposed as a means of integrating the available career information systems and maintaining maximum interface between the systems. The career information systems that were considered include U.S.O.E.'s 15 clusters, the Humm-RRO Model, the Standard Industrial Classification, and the Dictionary of Occupational Titles, Volumes I and II.

## INDUSTRIAL ARTS FOR THE COMPREHENSIVE HIGH SCHOOL

### Objectives

The following five goals as established in *A Guide to Improving Instruction in Industrial Arts* (1968) are believed to be unique to industrial arts.

- Goal I —Develop an insight and understanding of industry and its place in our culture.
- Goal II —Discover and develop talents, aptitudes, interests, and potentialities of individuals for the technical pursuits and applied sciences.
- Goal III—Develop an understanding of industrial processes and the practical application of scientific principles.
- Goal IV—Develop basic skills in the proper use of common industrial tools, machines, and processes.
- Goal V —Develop problem-solving and creative abilities involving the materials, processes, and products of industry (p. 9-11).

Industrial arts in the comprehensive high school is seen as a subject area that “interprets the functions, technology, and occupational opportunities of our modern industrial society . . . Students see and experience the unity or wholeness of modern industry (p. 13).”

More specifically, the high school industrial arts curriculum attempts:

1. To provide adequately for basic instruction to meet the needs of at least three types of students: (a) students who explore more deeply the avocational, cultural understanding, and consumer aspects of American industry, (b) students planning to pursue advanced study and careers in the areas such as the applied and technical sciences, and (c) those who will be entering the labor force before graduation or immediately after.

2. To provide practical situations dealing with the industrial world of work and provide understandings of the competitive nature of industry and business.

3. To provide basic skills which are useful in a variety of occupations or for occupational adjustment (p. 13-14).

### **Current Structure of Programs**

A national survey of industrial arts programs, teachers, students, and curriculums is available through Schmitt and Pelley's (1966) works. The study notes that the major portion of industrial arts instruction is provided through the study of woodworking, metalworking, and drafting. The remainder of the instruction centers around courses such as electricity-electronics, graphic arts, plastics, power mechanics, and crafts. In summarizing their findings, Schmitt and Pelley observe one major fact that stands out: "The current industrial arts curriculum does not even measure up to the program recommended by the profession 10 to 20 years ago." (p. 30)

Pine's study (1969) reviewed the literature to identify contemporary curriculum approaches that might provide the profession with alternatives to help eradicate Schmitt and Pelley's findings. Although many new and promising curriculum conceptualizations have been developed, too often the developmental work did not include complete instructional systems that could be readily adopted by industrial arts teachers in the classroom. The few curriculum projects that have developed complete instructional packages are making encouraging progress in their dissemination efforts. However, the fact still remains that most industrial arts programs are of a traditional nature and, in the author's opinion, they are not adequately meeting the objectives previously established.

## **HOMOGENEITY OF THE SCHOOL-BASED CAREER EDUCATION CONCEPT AND INDUSTRIAL ARTS EDUCATION FOR THE HIGH SCHOOL**

### **Homogeneity of Objectives**

Five industrial arts objectives and five school-based CCEM objectives have been established in *A Guide to Improving Instruction in Industrial Arts* (1968) and *Requirements of the Comprehensive Career Education Model* (1971) respectively. Figure 4 provides a comparison of the two sets of objectives from which a judgment can be made as to their homogeneity.

Each industrial arts objective is listed in order with each CCEM objective to which it contributes being noted next to it.

The analysis of objectives clearly shows that industrial arts can make a significant contribution to four of the five CCEM objectives. Although industrial arts has traditionally incorporated the use of community resources in its programs (CCEM objective 5), it is not a primary objective of industrial arts. Therefore, homogeneity exists between the industrial arts objectives and four of the five CCEM objectives.

<i>Industrial Arts Objectives</i>	<i>CCEM Objectives</i>
If a student is being helped to . . .	then he is being helped to . . .
(1) develop an insight and understanding of industry and its place in our culture,	(1) receive an education structured around real life.
If a student is being helped to . . .	then he is being helped to . . .
(2) discover and develop his talents, aptitudes, interests, and potentialities for the technical pursuits and applied sciences,	(4) receive a relevant program that provides for his becoming a self-fulfilled, productive, and contributing citizen.
If a student is being helped to . . .	then he is being helped to . . .
(3) develop an understanding of industrial processes and the practical application of scientific principles,	(2) receive an education that integrates academic knowledge and skill with occupational training.
If a student is being helped to . . .	then he is being helped to . . .
(4) develop basic skills in the proper use of common industrial tools, machines, and processes,	(3) prepare for further career education or for entry into an occupation.
If a student is being helped to . . .	then he is being helped to . . .
(5) develop problem-solving and creative abilities involving the materials, processes, and products of industry,	(1) receive an education structured around real life, and (4) receive a relevant program that provides for his becoming a self-fulfilled, productive, and contributing citizen.

Figure 4. Homogeneity Between Industrial Arts and CCEM Objectives.

However, there would appear to be a discrepancy between the central purpose of career education and the high school industrial arts program objectives previously cited. Several statements by Commissioner Marland noting his displeasure with the

“general education track” have already been cited. He proposes that “a universal goal of American education, starting now, be this: that every young person completing our school program at grade 12 be ready to enter higher education or to enter useful and rewarding employment.” (1971b, p. 5)

A major goal of the school-based CCEM is to “assure that each existing student will be prepared for further career education or for entry into an occupation. (Requirements, 1971, p. 1) In short, the overriding point of emphasis in the literature pertaining to career education is preparation for work.

Contrary to Marland’s statements and the goals of the CCEM, industrial arts has traditionally recognized the importance of its curricula for three types of students: “(a) students who explore more deeply the avocational, cultural understanding, and consumer aspects of American industry, (b) students planning to pursue advanced study and careers in the areas such as the applied and technical sciences, and (c) those who will be entering the labor force before graduation or immediately after.” (*A Guide*, 1968, p. 14)

The career education movement is purporting to relate knowledge and skills predominately to the world of work (occupations). However, if the school-based CCEM is to meet its goal of helping each student become “a self-fulfilled, productive and contributing citizen”, then knowledge and skills must also be related to the avocational, cultural, consumer, and educational aspects of life. The non-occupational aspects of life account for about two-thirds of a person’s waking hours. Achieving self-fulfillment in one’s occupation can not be equated with achieving self-fulfillment in life and the reverse is just as true. Education must be equally relevant to all aspects of living.

To suggest that we get rid of the general education track and bring in career education is, in reality, impossible to do. The implementation of career education in our public schools might improve general education but it can not replace it. Career education is not a body of knowledge but rather a concept. It is a means by which general education can be made relevant with respect to the world of work. Few educators would argue against the need for such reform. However, a child’s education must also be relevant to the two-thirds of his life when he will not be on-the-job.

A study of the world of work will include much knowledge and many skills that can be applied to non-occupational pursuits in life. A basic knowledge of fabrication techniques in the production of wood products can be utilized by an individual in a number of ways. While he may wish to pursue this area for occupational purposes, he may also utilize the same knowledge and skills in developing a hobby in some phase of woodworking. Still another application of the same knowledge and skills concerns the individual as a consumer. All students should possess a basic understanding of industrial production techniques and materials if they are to be intelligent consumers. Technology has played an important part in the development of our cultural heritage. An understanding of modern production techniques will certainly enrich a student's appreciation for the technological advances made by his forefathers.

The triangular model (Figure 5) used by CCEM to depict

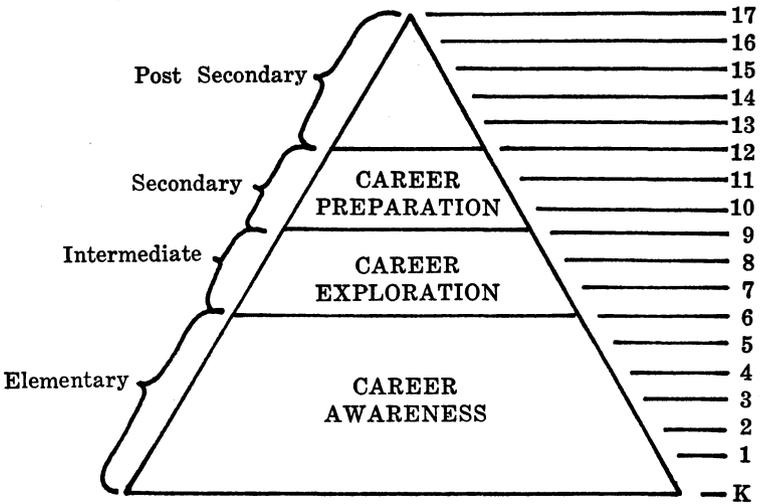
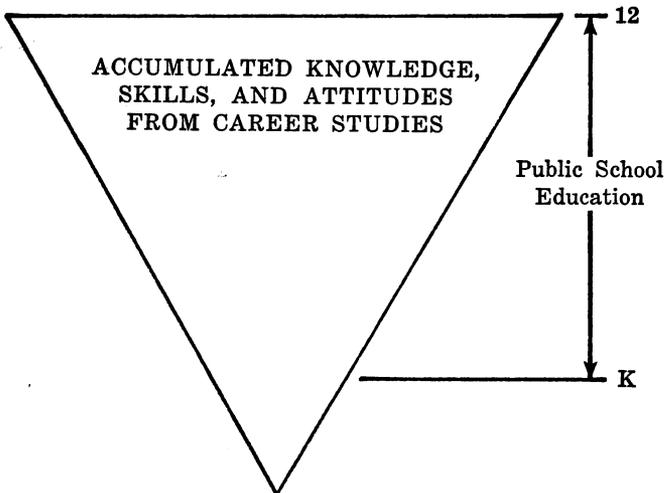


Figure 5. Scope of Career Studies.

the development of a student's career education studies does not accurately show the ultimate utilization of these understandings and skills. The student's career studies are very broad between kindergarten and sixth grade in an effort to make him *aware* of the overall, general job clusters. Starting at grade seven, he begins to narrow his perspective by *exploring* job

clusters of particular interest to him. By grade eleven, he has acquired some entry-level knowledge and skills and he is ready to begin specialized studies so that he is prepared upon graduation for gainful employment or to pursue his career goals through some form of post high school education. The model suggests that the ultimate use of the student's 12 years of career studies will be to get a job. A case has already been presented supporting the thought that career information should be and will be used by students in a variety of ways with each one being equally important.

While it is true that a student's career goals and studies will become more sharply focused as he makes career decisions, it must also be recognized that his wealth of knowledge, skills, and attitudes related to the world of work are continually expanding. This notion is depicted in Figure 6.



**Figure 6. Broadened Understandings of the World of Work.**

Grades seven through 12 comprise the decision-making period during which the student selects and rejects alternative career study areas as being compatible with his occupational goals. Figure 7 shows this portion of the student's career studies with respect to employability. However, areas of career information that are rejected as not being viable with respect to occupational goals may be accepted by the student as being relevant

to his avocational, cultural, consumer, or general educational needs. Therefore, the decision-making process is not just a "yes" or "no" affair but rather a process of sorting. The student should ask himself: Will these studies help me to fulfill my interests in life? If so, will they help me further my avocational, occupational, or general educational pursuits?

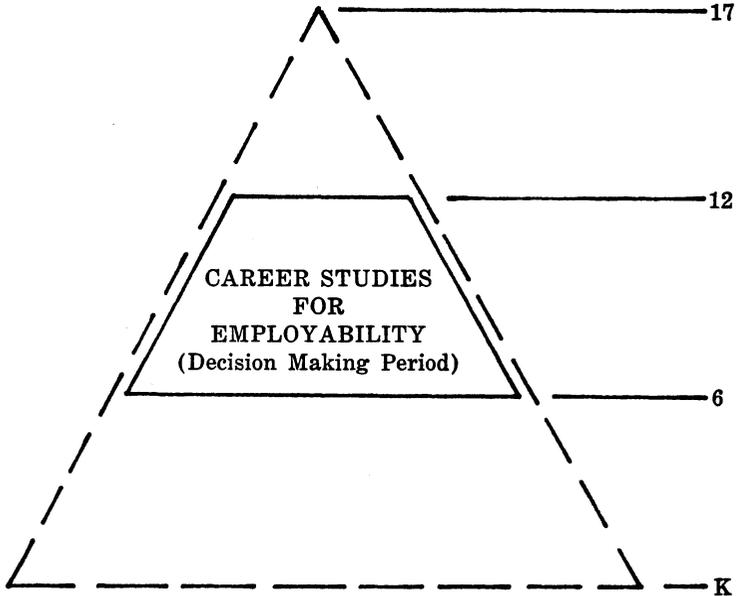


Figure 7. Career Decision Making Period.

A model denoting all of the benefits that can be derived from career education is proposed in Figure 8. Simply stated, a student's occupational goals and studies become more narrowly focused during his education while his experiential background (knowledge, skills, and attitudes) continually expands with the ultimate utilization of these experiences falling into three equally important areas.

Career education must include courses which are as concerned with education for "the good life" and general education that everyone should possess as they are with education for occupational pursuits. Industrial arts can make a significant contribution in all three of these areas. To be an intelligent consumer and to be industrially literate, all students should possess some basic understandings and skills with respect to industrial

technology. Numerous opportunities present themselves in industrial arts programs for students to pursue their avocational interests while at the same time acquiring entry-level knowledge and skills for employment.

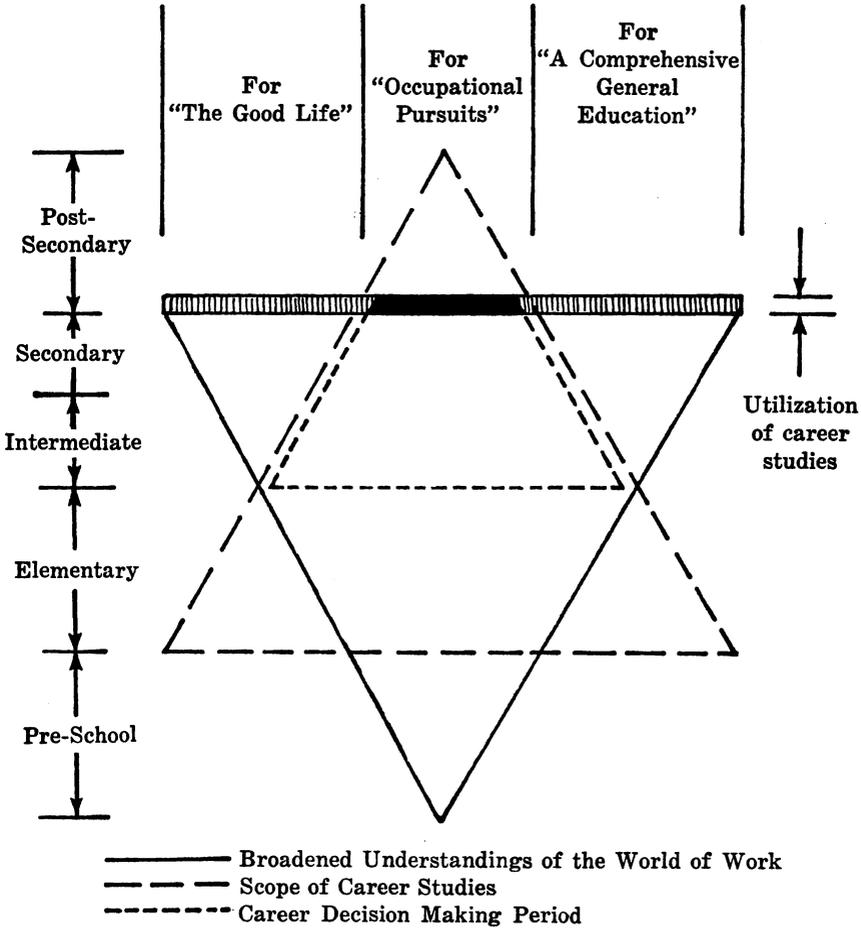


Figure 8. Proposed Career Education Model.

**Homogeneity of Programs**

Selection of subject matter content for any curricular area should be derived from an identifiable body of knowledge which is unique to that subject area. Industrial arts is a study of indus-

try and the technology used by industry to produce material goods. Therefore, industrial arts can be thought of as a study of industrial technology. Towers, Lux, and Ray's *A Rationale and Structure for Industrial Arts Subject Matter* (1966) provides a knowledge base for the study of industrial technology. They conclude that "industry's primary role is that of organizing resources and of substantially changing their form so that they yield the industrial material goods required to satisfy man's wants." (p. 148) Material goods are produced by either constructing them on site or manufacturing them in a plant. All material production can be classified under one of these two production technologies. Therefore, industrial construction technology and industrial manufacturing technology are the two basic subject areas to be studied within the industrial technology knowledge base.

These two basic areas are compatible with the career information model (Figure 3) since the career clusters specified in that model include construction and manufacturing. However, some industrial arts educators would argue that there are other subject areas appropriate for study under industrial arts. These proposed additional areas of study would most likely include transportation, communication, natural resources, and product services, to name a few. The issue in need of resolution is not whether they are appropriate for study under industrial arts, but how they are appropriate.

The body of knowledge from which a curricular area derives its content must be unique to that subject area. Referring back to Figure 2 will help illustrate this point. While transportation and communication play a significant role in the way man produces industrial material goods to satisfy his wants, they are not unique to industrial technology. The knowledge and practices inherent in transportation and communication technology are an integral part of government, education, recreation, personal services, the arts, social studies, language, and numerous other subject areas. To align studies of transportation technology and communication technology with industrial arts would imply that these broad areas are unique to industrial arts. If these two subjects are deserving of separate consideration, they might be more appropriately included under a study of commerce as noted in Figure 2.

The significance of transportation and communication to the study of industrial technology is limited to the extent that they affect the production of industrial materials goods. A study of transportation systems within manufacturing plants is significant and should be studied *within* courses on industrial manufacturing. A study of commercial airlines as a transportation system is not appropriate for industrial arts since they are not concerned with the production of material goods. The installation of electrical communication systems in homes and other structures is suitable for study under industrial construction technology. Studies of radio and television broadcasting networks are inappropriate within the context of industrial technology. Therefore, it is fitting to study transportation and communication only as they relate to the production of industrial material goods through construction and manufacturing practices.

The areas of natural resources and product services should be scrutinized in the same manner. The technology of maintaining (servicing) industrial products such as an automobile is a valid area of study under industrial technology. Managing and operating a service station is not relevant to industrial arts. While industrial arts most appropriately includes studies of the natural resources utilized by industry, a study of dairy farming as an initiate of natural resources would certainly be less than directly relevant to industrial technology. While the subjects of transportation, communication, services, and many others are *not unique* to industrial technology, they are significantly *related* to that body of knowledge and should be studied as they affect industrial construction and industrial manufacturing practices.

If construction and manufacturing are the appropriate areas of study for industrial arts, what portion of these areas are our current high school programs encompassing? Based upon Schmitt and Pelley's (1966) study, most high school industrial arts programs cover only a small part of the total knowledge base as depicted in Figure 9, showing construction and manufacturing within the CCEM career information model. At the time of Schmitt and Pelley's study, there were "over 202,000 classes in industrial arts education in the public secondary schools. However, only four industrial arts courses have a large number of classes: general industrial arts, 56,050 classes; general woods, 44,238 classes; drafting, 39,573 classes; and general metals,

28,911 classes (p. 22).” Within the general industrial arts courses, better than 61 percent of the students’ studies were devoted to woods, metals, and drafting. The four areas combined accounted for more than 83 percent of all industrial arts classes.

As noted in Figure 9, the production areas under manufacturing are fairly well represented in industrial arts programs. However, construction production courses are few. For example, within the general woods courses identified by Schmitt and Pelley, less than 14 percent of the instruction pertained to construction. While drafting accounts for close to 20 percent of all industrial classes, it is only a minor part of the total industrial managerial function.

The inclusion of specific information on worker traits and educational qualifications is often sporadic or non-existent in industrial arts courses. The voids that exist in the areas of construction and manufacturing are apparent. Industrial arts should be offering a comprehensive study of these two career cluster areas so the entire body of knowledge and the occupations represented therein are adequately represented (Figure 10).

## **A PROPOSED CURRICULAR APPROACH FOR HIGH SCHOOL INDUSTRIAL ARTS**

### **Objectives**

As a result of selected learning experiences in the proposed high school industrial arts program, students should be able to:

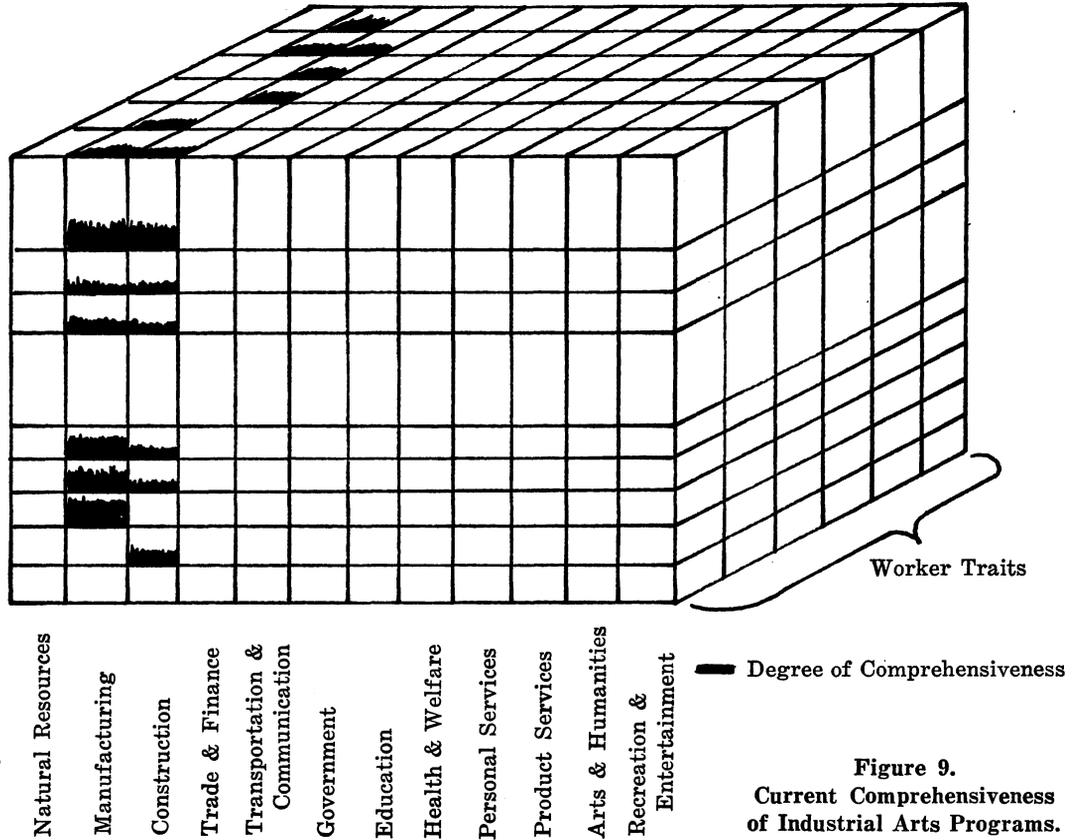
1. exhibit an understanding of the basic principles, concepts, and problems of industrial technology.
2. demonstrate an understanding of the significance of materials, processes, products, and occupations in our industrial technological world, and the nature of their impact upon our society.
3. apply industrial knowledge and skills in their avocational, consumer, occupational, and educational pursuits.

### **Program Outline**

Drawing upon industrial technology as an identified body of knowledge (Towers, Lux, and Ray, 1966), a curriculum structure for high school industrial arts is proposed as depicted in Figure

*D.O.T.  
Occupational  
Divisions*

Professional  
Technical  
Managerial  
Clerical  
Sales & Service  
Farming  
Fisheries  
Forestry  
Processing  
Machine Trades  
Bench Work  
Structural  
Miscellaneous



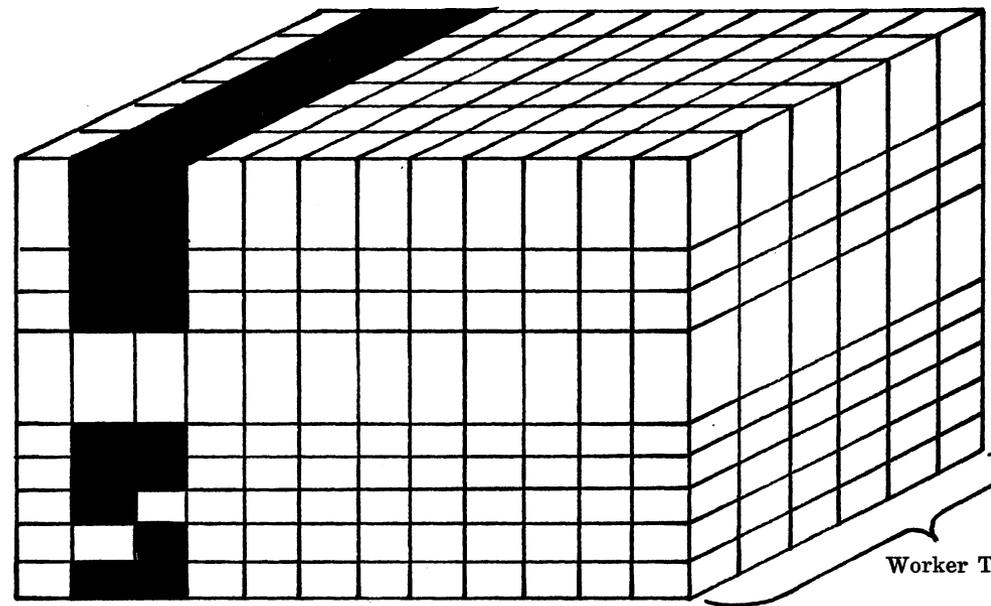
*CCEM  
Career  
Clusters*

— Degree of Comprehensiveness

**Figure 9.**  
**Current Comprehensiveness**  
**of Industrial Arts Programs.**

*D.O.T.  
Occupational  
Divisions*

Professional  
Technical  
Managerial  
Clerical  
Sales & Service  
Farming  
Fisheries  
Forestry  
Processing  
Machine Trades  
Bench Work  
Structural  
Miscellaneous



*CCEM  
Career  
Clusters*

Natural Resources  
Manufacturing  
Construction  
Trade & Finance  
Transportation & Communication  
Government  
Education  
Health & Welfare  
Personal Services  
Product Services  
Arts & Humanities  
Recreation & Entertainment

■ Degree of Comprehensiveness

Worker Traits

**Figure 10.**  
Desired Comprehensiveness of  
Industrial Arts Programs.

11. Industrial construction technology and industrial manufacturing technology are studied in the seventh and eighth grades respectively. The ninth and tenth grade level courses would provide exploratory experiences in the areas subsumed under them. These five courses are the first level courses for high school students, but in the total matrix they comprise the third order. They would be prerequisite courses for students interested in taking fourth-order courses. They would also be recommended to students electing to pursue non-occupational interests.

Eleventh and twelfth grade courses would be elected from the fourth-order areas in the matrix. Fourth-order courses would be for students possessing more specialized interests in the areas indicated. Although they are more narrowly focused, these courses would still offer a general coverage of the subject matter. Entry-level knowledge and skills would be developed in a number of occupational areas. However, job training in specific occupational areas is not a goal of these courses and, for that matter, is not a goal of industrial arts. Students seeking this sort of training would take the appropriate courses in vocational education.

An outline of general topics to be covered in each fourth-order course follows. Again, the content for the third-order courses would be a composite of the fourth-order areas subsumed under them.

*Construction Site Management Technology Course outline*

- Selecting a site
- Buying real estate
- Surveying and mapping
- Soil testing
- Contracting
- Estimating and bidding
- Scheduling
- Making inspections

*Hypothetical program operation.* This one-semester course (one hour/day) utilizes drafting room facilities with an adjoining general laboratory. Students receive structural plans from the preceding structure management class. Working from the given plans, students carry out the various pre-construction management functions. After site requirements are studied and

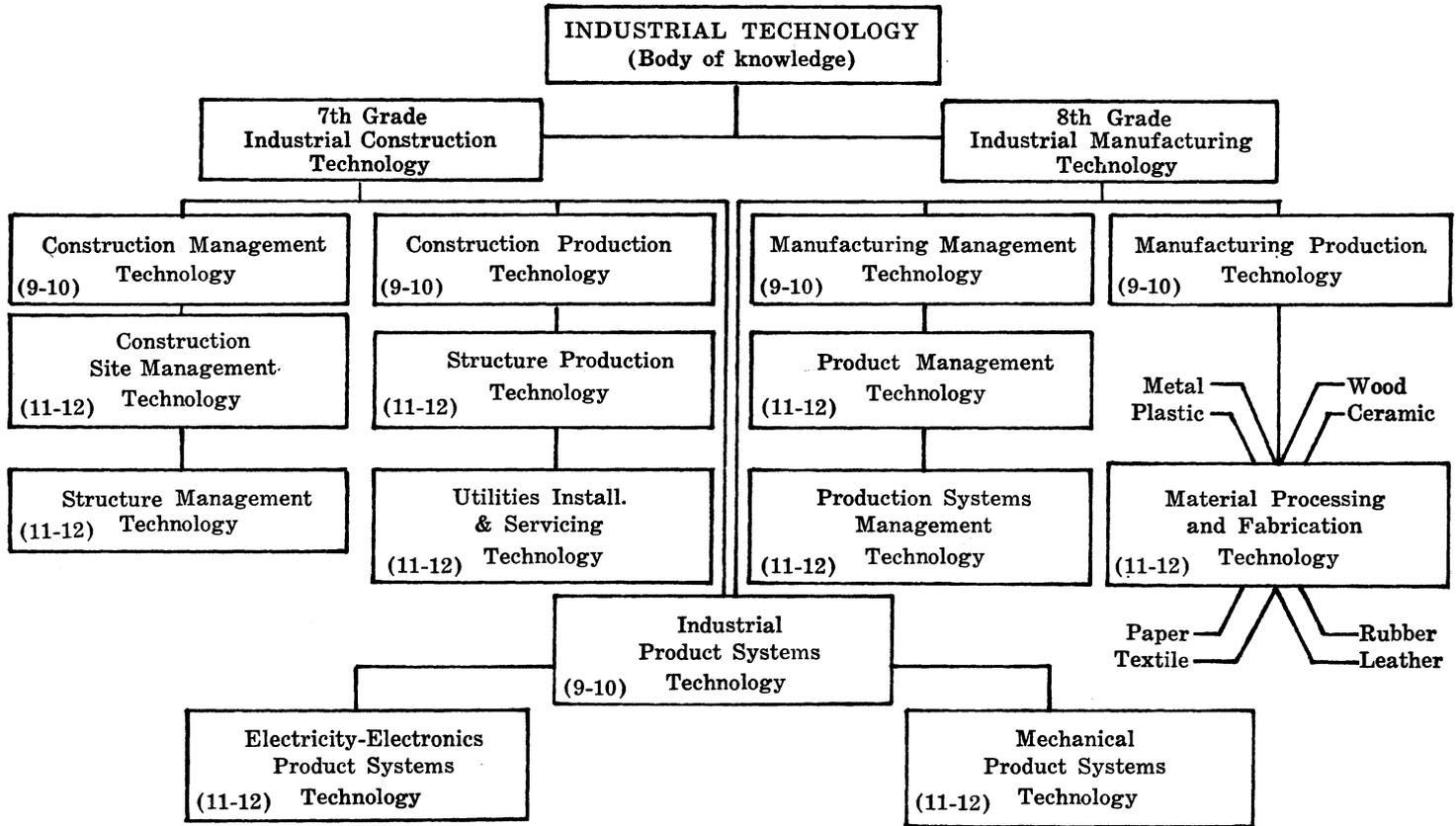


Figure 11. Curriculum Structure for Industrial Arts.

a final (hypothetical) site near the school has been selected, the lot is surveyed by the students and all necessary maps developed. Students prepare for this experience through a one-week cooperative work-experience program with a local surveying company. The semester concludes with students accepting the role of builder. Activities in estimating construction costs, submitting bids, and drawing-up contracts are pursued.

*Structure Management Technology Course outline*

- Identifying the design problem
- Developing preliminary ideas
- Refining ideas
- Analyzing the design
- Making working drawings
- Writing specifications
- Constructing models

*Hypothetical program operation.* In this one-semester program, students design and develop plans for a structure working within basic specifications provided by the instructor. Plans are often developed for construction jobs contracted by the structure production technology classes. Students realize the end result of their designing and engineering efforts after a scale model is built. The drafting room provides the main facility for this course.

*Structure Production Technology Course outline*

- Setting foundations
  - Building forms
  - Setting reinforcement
  - Mixing concrete
  - Placing and finishing concrete
  - Completing foundations
- Building superstructures
  - Building mass and masonry superstructures
  - Erecting steel frames
  - Erecting concrete frames
  - Building wood frames
- Enclosing framed superstructures
  - Roofing
  - Enclosing exterior walls
  - Insulating

- Applying wall materials
- Applying ceiling materials
- Laying floors
- Finishing the project

*Hypothetical program operation.* As a two-semester course, this experience provides students with entry-level skills in numerous occupations. A basic knowledge of construction materials and techniques affords the student consumer knowledge as well as home maintenance skills. Activities are divided between small construction jobs and laboratory sessions using construction modules. Construction jobs are undertaken by contract with local businesses, private parties, and within the school system. Projects have included bus-stop shelters, garages, tool sheds, park shelters and bridges, school-fair booths, and an athletic field refreshment stand. The general construction laboratory serves this course in addition to the construction management classes.

*Utilities Installation and Servicing Technology Course outline*

- Installing heating, cooling, and ventilating systems
- Installing plumbing systems
- Installing piping systems
- Installing electrical power systems
- Installing electrical communications systems
- General home maintenance

*Hypothetical program operation.* This course gives the student a one-semester overview of the occupational opportunities related to the installation of the various utilities required in most structures. General home maintenance procedures which every homeowner should know are an integral part of this course. These classes provide the utilities installation work required for the contracted construction jobs. Each student must complete five hours of school maintenance *study* under the supervision of school maintenance personnel. The construction laboratory is used for this course.

*Product Management Technology Course outline*

- Identifying consumer demands
- Researching and developing products
- Designing manufactured goods
- Making working drawings

Building production prototypes  
Technical writing and illustrating

*Hypothetical program operation.* This two-semester program is coordinated with the material processing and fabrication technology classes. Product ideas for production runs are formulated, designed, and developed. An adjoining general manufacturing laboratory provides the needed facilities for constructing prototypes. Most learning activities can be accommodated in the drafting room.

*Production Systems Management Technology Course outline*

- Planning processes
- Automating processes
- Measuring work
- Estimating cost
- Tooling up for production
- Installing production control systems
- Operating quality control systems
- Designing and engineering the plant
- Supplying equipment and materials
- Processing data or information
- Computers in production

*Hypothetical program operation.* Manufacturing production classes provide the simulated plant setting for many of the activities in this course. Work measurement, planning production techniques, and tooling-up are just some of the areas of study coordinated with the production classes. A local manufacturing firm assists this program through a cooperative effort to provide students with 10 hours of direct experience working with production planning personnel. While most activities are conducted in the general manufacturing laboratory, the adjoining drafting room is available when needed.

*Material Processing and Fabrication Technology Course outline*

This area consists of a series of courses. The general manufacturing production technology course is elected in either the ninth or tenth grade. Advanced manufacturing production courses in specialized areas can be elected after completing the general course.

*Hypothetical program operation.* Students select areas of interest from the following courses:

“Manufacturing Production Technology”: This ninth or tenth grade course is offered in the general manufacturing production laboratory equipped with basic woodworking, metalworking, and plastics facilities. Other material areas are incorporated where desirable. The course emphasis centers on mass-production techniques.

Advanced production techniques are explored through the following courses:

“Manufacturing Production Technology—Woodworking”

“Manufacturing Production Technology—Metalworking”

“Manufacturing Production Technology—Printing”

Each course offers learning experiences in a specialized area of production technology. Activities include both mass-production work and individual study. Students are afforded the opportunity to explore more specialized occupations while at the same time to pursue areas of personal interest to them.

*Electricity-Electronics: Product Systems Technology Course outline*

Electrical phenomena (principles)

Production, distribution, and utilization of electricity

Utilizing electrical energy for electronic devices

Measurement

Control

Applications

Designing and engineering electronic devices

*Hypothetical program operation.* In a two-semester course, students explore the principles of electricity/electronics and their application to the design and manufacture of industrial products. The product systems technology laboratory provides the facilities for both this course and the mechanical product systems technology course. Basic electricity/electronics, metalworking, and materials testing equipment is provided.

*Mechanical product systems technology Course outline*

Simple machine elements

Mechanical properties of materials

Thermal properties of materials

Electrical properties of materials  
Chemical properties of materials  
Basic mechanisms  
Hydraulics and pneumatics  
Metallurgy

*Hypothetical program operation.* This two-semester course offers students an exploratory experience in the mechanical principles utilized in designing and engineering industrial products. Students analyze given product designs in terms of materials used and their appropriateness for that product. Materials testing activities make a significant contribution to the course. The course concludes with students developing a product design and prototype to meet given specifications and then testing their individual designs.

### SUMMARY AND CONCLUSIONS

All students need a basic understanding of our economic system and the world of work. Every student should receive an education that will prepare him to pursue his career interests. These career interests can be of the wage-earning type working "at the office" or of the non-wage-earning type such as raising a family at home. The need for such education has long been recognized by educators. However, the results of past educational endeavors in this area have not been overly encouraging. High student drop-out rates continue, due to what they see as irrelevant programs. Those students completing their high school education too often have unrealistic views of the world of work. Even when students do make intelligent career decisions, they often find a lack of school programs that will assist them in pursuing their career interests.

Career education has been proposed as a means of eliminating these educational ills. Four career education models are currently being developed by various research and development agencies under contract with U.S.O.E. Within the school-based Comprehensive Career Education Model (CCEM), the major intent is to organize the kindergarten through twelfth grade curricula around a study of careers. In light of the proposed reorientation of school studies, the question of the role of existing curriculum areas within the context of career education should be paramount

in the minds of educators. This paper has addressed itself to this question with respect to high school industrial arts education.

Although the objectives of industrial arts and career education exhibit homogeneity, the philosophies of the two approaches differ with regard to the student's purpose in pursuing career studies. Career education supports its efforts with the rationale that students need career studies to prepare for occupational pursuits. A case has been presented for industrial arts as a part of career education to meet three equally important student needs: (1) avocational interests, (2) industrial literacy, and (3) career endeavors. The concept of career education must embrace the notion that while career studies are vital to each and every student, the knowledge and skills acquired by a student must help him develop a complete life style. Perhaps the term "life education" would more appropriately describe the educational needs of our youngsters. A student's education, whatever you call it, will be ultimately utilized for either occupational pursuits, for living "the good life," or for general educational purposes that will make him an intelligent, contributing member of society.

With industrial technology as the body of knowledge from which industrial arts should draw its content, industrial construction technology and industrial manufacturing technology are delineated as the two major subject matter areas. These two technologies are compatible with the career education model of career clusters. However, most industrial arts programs do not provide a comprehensive study of construction and manufacturing practices. Programs need to be redefined and restructured if industrial arts is to offer a contemporary study of industrial technology.

In essence, career education is purporting to make school relevant to real life situations. Industrial arts has professed to be doing this since its inception. However, relevancy can not be achieved without a contemporary curriculum structure. This is the problem to which industrial arts educators must address themselves.

## REFERENCES

- Campbell, R.E., "Vocational Guidance in Secondary Education: Selected Findings of a National Survey Which Have Implication for State Program Development." Paper presented at the National Conference on Vocation Guidance: Development of State Programs, U.S. Office of Education, Washington, D.C., January, 1968.
- "Career Information System Model." Unpublished manuscript, The Center for Vocational and Technical Education, The Ohio State University, 1972.
- Gribbons, W.D., and P.R. Lohner, *Career Development: Cooperative Research Project No. 5-0088*, Mars: Regis College, 1966.
- A Guide to Improving Instruction in Industrial Arts*. Washington, D.C.: American Vocational Association, 1968.
- Hoyt, K.B., "High School and the Specialty Oriented Student Research Program." *Vocational Guidance Quarterly*, 1965, 13(4), 229-236.
- Marland, S.P., "Career Education—More Than a Name." Paper presented at the annual meeting of the State Directors of Vocational Education, Washington, D.C., May 1971. (a)
- Marland, S.P., "Career Education Now." Paper presented at the convention of the National Association of Secondary School Principals, Houston, January 1971. (b)
- Peters, H.J., and J.L. Hensen, *Vocational Guidance and Career Development*. New York: Macmillan Co., 1966.
- Pine, D.T., "Contemporary Curriculum Proposals in Industrial Arts Education." Unpublished manuscript, Trenton State College, 1969.
- The President's Commission on School Finance, *Schools, People and Money*, U.S. Government Printing Office, 1972.
- "Requirements of the Comprehensive Career Education Model." Unpublished manuscript, The Center for Vocational and Technical Education, The Ohio State University, 1971.
- Schmitt, M.L., and A.L. Pelley, *Industrial Arts Education: A Survey of Programs, Teachers, Students, and Curriculum*. Bureau of Research, Office of Education, Washington, D.C.: U.S. Government Printing Office, 1966.
- Slocum, S.L., and R.T. Bowles, *Educational and Occupational Aspirations and Expectations of High School Juniors and Seniors in the State of Washington*, Vocational-Technical Research and Development Project No. 1. Pullman, Washington: Washington State University, 1967.
- Towers, E.R., D.G. Lux, and W.E. Ray, *A Rationale and Structure for Industrial Arts Subject Matter*. Report No. BR-5-0059-A, November, 1966, The Ohio State University, Contract No. OEC-5-85-066, U.S. Office of Education.

**Senior High School  
Industrial Arts Programs:  
A Study of Careers Through  
the Use of Community Resources**

*Robert J. Ullery  
Industry Education Coordinator  
New York State Education Department*

Regardless of which educational philosophy, or modification thereof, is to be adopted for a high school industrial arts program, it appears that programs of the future are likely to be much more highly geared to career motivation and guidance than some programs of the past. Undoubtedly, program design of the future must make optimum utilization of community resources of all types. Only through such extension of schools into the community can realistic information be provided for learners concerning career opportunities.

*Field trips into business and industry* have long been considered a desirable extension of educational efforts at all academic levels. Unfortunately, restrictions imposed by school budgets frequently deny as many field trips as a teacher might wish to schedule. Obviously, few educators would attempt to defend an inadequate school budget for this or any other purpose. It is imperative that educators at all levels and for all subject matter discipline areas explore techniques of achieving

maximum efficiency for each dollar expended. This condition may result in a prescription for a modified approach to field trip activity.

Field trips in the past have frequently consisted of herding multiple class sections, sometimes from varying grade levels, into a school bus for the purpose of traveling several miles to a destination whereupon excited learners disembark to be herded (in too-large groups) through noisy manufacturing facilities and subsequently back into the bus for the joyous return to school. Pitifully, little evaluation of overall field trip effectiveness occurs at the local school level. Is it possible that field trips could be improved?

A modification in field trip design could result in a more beneficial experience for the participants. Thus suppose, for example, that a group of 30 students were to be exposed to the activities of a typical newspaper publisher. Through pre-planning, it should be possible to locate students at strategic observation points throughout the plant. Perhaps five students would be at observation points within the editorial rooms, a second five at observation points in the makeup department, another five students in the classified and advertisement section, additional groups in the pressrooms and in the areas of distribution. Effective planning could provide for rotation of students within their respective departments at intervals of perhaps 30-40 minutes. Such a plan would acquaint students rather thoroughly with the various departments within a typical newspaper publishing operation.

At the conclusion of such a field trip, each of the several groups of students would have acquired an indepth knowledge of a particular phase of activity leading to classroom discussion of ways in which one major activity or department relates to another. A similar plan could be used in any manufacturing facility or business visit. The opportunity to observe a practitioner in action is thus magnified far beyond the casual observation possible during a typical field trip.

*Work experience opportunities* can be of great value to secondary school youth, particularly if such experiences are in some way related to career considerations. Clearly, industrial arts education can play this role without being charged with skill or vocational training as a goal. The Board of Regents of the

University of the State of New York have said in their Position Paper No. 11, "Actual work experience and community service related to career interest ought to be a part of the curriculum for all secondary school students. No other single change in public education could do more to answer the demand for relevance, to break down the walls between the school and the community, and to bridge the gap between generations."

Educators frequently lament the fact that *pupils seldom know much about their parents' careers*. While schools have been somewhat effective in inviting parents to accompany children to school for open house evenings and other occasions, little effort has been made to devise a technique for students to become aware of their parents' occupations. Is there any reason that a part of an industrial arts program at the early secondary level should not include an opportunity and an obligation on the part of each student to remain away from school for a single day for the purpose of accompanying a parent to the place of employment? Obviously, such a program would require understanding on the part of community employers and would raise questions as to effective planning for students whose parents are unemployed. These, however, are minor administrative details in comparison with the need which can be fulfilled with such a simple program. Student participants in such a program would acquire much more information than that available through direct observation only of their parent. In most instances, participation in such a program would provide an opportunity to see many other workers in the environment shared by their parent.

A reasonable extension to the previously mentioned program would be a plan to *provide for the absence of secondary school juniors or seniors* for periods of up to one week on perhaps as many as three separate occasions to observe a practitioner in the occupation of the student's choice. After an observation period of up to one week, a student will have developed stronger, weaker, or other attitudes concerning his tentative occupational choice. Regardless of his feelings after the first week of observation, an opportunity should be provided to visit a second practitioner in the same occupational area or in a second occupation which may or may not be directly related to that which was first observed. Such a program can provide strong assistance in career

guidance and is absolutely impossible of fulfillment by visits to the guidance office or by personal discussions with teachers.

*Organized labor has the capacity to provide a great deal of career guidance information directly to students.* Most states have a directory of labor organizations available through the department of labor, providing an index of potential speakers in the classroom.

The New York State School of Industrial and Labor Relations has conducted a special union vocational advisory project in selected schools within New York City in which organized labor representatives visit school classrooms, frequently at the rate of 4 such speakers per class period. Subsequent to such exposure, students are provided an opportunity to express their feelings in regard to occupations to which they have been exposed. Those that express strong acceptance are subsequently invited, together with their parents, to the nearby Union Hall for an evening presentation allowing an opportunity for questions and answers among students, parents, and labor representatives.

*School assembly programs* can be designed to utilize representatives of nearby business and industry. Such persons frequently are able to provide a demonstration type program complete with appropriate audio-visual aides and sometimes hand-out literature for student participants. Exposure to such community resources can be very helpful in providing an opportunity for students at all grade levels to become more familiar with occupations to which they might aspire. The public relations value of such business and industry involvement cannot be overestimated. All communities have access to such possibilities through contact with power companies, telephone companies, banks, social service agencies, manufacturing concerns and other businesses.

Use of the *Educators Guide to Free Guidance Materials* (published by Educators Progress Service, Inc., Randolph, Wisconsin) can provide a valuable supplement to industrial arts class presentations concerning career guidance and can occasionally be an effective coordinant activity related to school assembly programs previously mentioned.

*Student club groups* can occasionally be sponsored by nearby business or industry interests. One such national group with

provisions for local charters is the Junior Engineering and Technical Society. This youth group is sponsored by the Engineers Council on Professional Development. One significant activity of this national organization of particular interest to industrial arts education is the National Aptitude Examination for Engineering administered on an annual basis. Other appropriate activities for local chapters include the development of science and engineering type fairs. A national fair is available for outstanding participants from local levels within the United States.

*Museums provide an additional valuable resource.* Museum management is moving away from the stuffy, "don't touch" atmosphere and into an enlightened educational, "please touch" approach. *Museum Resources and Their Utilization in Industrial Arts Education* was the subject of a doctoral dissertation at New York University by B.J. Ross. Dr. Ross points out, "since a primary mission for industrial arts is to provide an understanding of American industry with the awareness of its changing technology, its comprehensive content implies a changing and varied methodology."

It is virtually impossible to visit any up-to-date museum without exposing learners to career possibilities in a variety of occupational areas.

*Professional, scientific and technological societies* exist in almost every section of the United States. Such organizations frequently have education committees and in many instances, a willingness to be of service to educational institutions. These organizations relate to career orientation. In many cases, the local chapters of scientific and technological societies are not of sufficient size to warrant the employment of a full-time executive secretary or even to be listed in the local telephone directory. For this reason, it becomes important for educators to develop a list of key contact persons for such organizations. In some areas of the country, regional councils of scientific societies have been formulated, thus providing a convenient avenue of communication with a variety of organizations through a central source. An outstanding example of such a pattern exists in and around Rochester, New York where, over 18 years ago, the Rochester Council of Scientific Societies was formed. This organization consists of representation from nearly 30 regional groups, many of which exist at the local chapter level in other parts of the United States.

The Rochester Council includes the following societies:

American Association of Clinical Chemists  
American Chemical Society  
American Institute of Chemical Engineers  
American Institute of Industrial Engineers  
American Physical Society  
American Society for Metals  
American Society of Civil Engineers  
American Society of Mechanical Engineers  
American Statistical Association  
Computer Systems Association  
Genesee Valley Psychological Association  
Institute of Electrical and Electronics Engineers  
Instrument Society of America  
Monroe County Dental Society  
New York Society of Professional Engineers  
Optical Society of America  
Rochester Academy of Medicine  
Rochester Academy of Sciences  
Rochester Engineering Society  
Rochester Society for Quality Control  
Scientific Research Society of America  
Seneca Zoological Society  
Society of Motion Picture and Television Engineers  
Society of Photographic Scientists and Engineers  
Society of Plastics Engineers  
Society of Sigma Xi

The Rochester Council of Scientific Societies assists in the local section of the Student Association of Mathematics and Science; provides speakers on a variety of industrial and career related topics, a list of which is provided to all schools in the area; arranges for industrial and scientific tours; and most importantly provides for industrial career counseling. A quote from the Council's Handbook expresses vividly the service rendered: "If a student, his parents or his teacher would like a personal interview with a practicing scientist or engineer, arrangements can be made through the Rochester Council of Scientific Societies. The interview could be at the office of the scientist or engineer, at the school, or at the student's home."

Regional chapters of professional societies are, in many instances, affiliated with a national organization which frequently produces instructional materials and career motivation literature. *Many national organizations produce career materials* not readily available through any source other than the parent organization or its affiliates. One example of such materials is a recent career guidance film entitled, "How to Crack the Establishment" available through the Plastics Education Foundation at 4 Lorna Lane, Loudonville, New York.

The recognized need for improved communication between education and the education related interests of business, industry and organized labor has resulted in the appointment of coordinators of such activity in local school systems, in State education departments and recently, at the U.S. Office of Education. Industrial arts educators wishing to contact the Federal Coordinator for Industry Education Labor may reach him at the following address: Mr. Louis G. Mendez, Jr., Federal Coordinator for Industry Education Labor, U.S. Office of Education, Room 4143 FOB #6, 400 Maryland Avenue, S.W., Washington, D.C. 20202. The Federal Coordinator maintains a directory of regional U.S. office coordinators, as well as State industry education coordinators.

Industrial arts educators should become familiar with career guidance related assistance available through the *National Association for Industry Education Cooperation* and regional chapters of the national body in various parts of the United States. Membership is open to educators in both the national group and its related local organizations. Additional details regarding membership and activities of the National Association for Industry Education Cooperation may be obtained through correspondence with Carol A. Lindstrum, Secretary, National Association for Industry Education Cooperation, c/o J.C. Penney Co., Inc., 1301 Avenue of the Americas, New York, New York 10019. The National Association will be able to provide information regarding regional chapters as they exist in sections of the United States.

*The New York Regional Council for Industry Education Cooperation* includes membership representing the following, each of which has career guidance information available to educators. The Aluminum Association, American Cyanamid Company, AMF, Inc., Bell Laboratories, The Brownington Foundation, Central

Jersey Industry Education Council, Century Consultants Corporation, Coats and Clark, Inc., Consolidated Edison Company of New York, Inc., Dairy Council of Metropolitan New York, Dow Jones and Co., Inc., Economic Development Council of New York City, Inc., Edison Electric Institute, Educators Progress Service, Inc., Filmcraft, Institute of Life Insurance, Instructional Materials Laboratories, Inc., Irv Levine Associates, Jersey City State College, Johnson & Johnson, Junior Achievement, Inc., Keep America Beautiful, Inc., Long Island Lighting Company, McCall Pattern Co., Modern Talking Picture Service, Inc., National Association of Manufacturers, New Jersey State Department of Education, New York City Council on Economic Education, New York State Education Department, New York Stock Exchange, New York Telephone Company, The New York Times, J.C. Penney Co., Inc., Personal Products Company, Plastics Education Foundation, Public Education Association, Scott Education, Scholastic Magazines, Inc., Sealtest Foods Division of Kraftco, Union Carbide, Inc., New York City Community College, Wagner College, WNYE-TV Channel 25 (Educational Television), American Stock Exchange, Inc., Teachers Guides to Television, Inc., Photographic Application Company, Cooperative Education Bureau. The directory of membership to the aforementioned council includes reference to materials available through the member organizations.

It is imperative that educators strive for optimum balance in program design, including reasonable allocations for content derived from the material or power area of study and specific career orientation and motivation activity. An emphasis on career education, coupled with efforts to promote use of community resources, is likely to result in increased time allocation in secondary industrial arts to the study of careers and will consequently necessitate improved understanding of effective methodology. Hopefully, the references contained herein will be helpful to persons planning secondary industrial arts programs for the future particularly as they relate to career identification, student motivation for careers, and orientation.

# Industrial Arts

## Career Education

*R. J. Agan*  
*Professor and Coordinator of Vocational Education*  
*Sam Houston State University*  
*Huntsville, Texas*

The concept of Industrial Arts Career Education was parented by interdisciplinary vocational education and industrial arts curriculum projects. Interdisciplinary vocational education was brought into focus with the passage of the Vocational Education Act of 1963 and subsequent legislation. Various funded projects under the new legislation, including the Paola, Kansas/Kansas State University Project, (1965-1968) demonstrated the total uselessness of the traditional barriers between fields and programs which are all, in final analysis, dedicated to the goal of preparing boys and girls, men and women, for proficiency in an occupational field of their choice. Such interdisciplinary demonstrations further brought to the attention of visionary educators the vast area of common subject matter and clusters of occupationally related information existing in each of the traditional fields of vocational education (agriculture, distributive and office education, homemaking, trades and industry). Also brought to attention was the duplication and waste rampant in many programs of vocational education whose teachers were more interested in numbers of students enrolled in their specialty programs and the awards

won for departmental trophy cases than in efficient and economical vocational education. In the interdisciplinary programs designed, one course, frequently called *Commonalities in Occupations*, taught by a team of teachers, was found adequate to serve all of the traditional fields in presenting the common parts of the vocational learning experience.

Interdisciplinary demonstrations further illustrated that teachers without the benefit of specialized teacher preparation in vocational education could function effectively as an educational team member along with teachers prepared in vocational education to provide a complete and total program of vocational education for boys and girls at the secondary level; such programs including (1) occupational information and career selection criteria, (2) self assessment learning activities related to career choice and (3) learning experiences exploring occupations and those which lead to preparation in a specific chosen career field.

Another important partner in the educational process—the school community composed of successful businessmen and tradesmen—was given a star role in the experimental and exemplary programs in Interdisciplinary Vocational Education. Such community participants were found to be eager and anxious to cooperate fully with the public school educational team dedicated to providing learning experiences designed to meet the needs of students in career selection and preparation.

An Industrial Arts Curriculum Project was started about the same time (1965) growing out of a deep concern as to whether the traditional craft-oriented programs in drafting, metalworking and woodworking were providing adequate overviews of technology for students who were to enter the world of work. This project, initiated jointly by persons at The Ohio State University and the University of Illinois, resulted in a two-phase program dedicated to the objectives of (1) creating understanding of industrial technology, (2) developing interest in and appreciation for industry as a provider of satisfactions of human wants and (3) demonstrating useful knowledge and skills for life situations.

The first phase of the resulting newly developed instructional program is called "The World of Construction," a year-

long course for junior high school students where the knowledge and skills common to the construction industry are emphasized. The decision making process is accentuated and the learning experiences include tradesmen skills as well as the skills of hiring personnel, contract bidding, etc. Role playing is a learning technique frequently used when appropriate.

The second phase is called "The World of Manufacturing" and is likewise directed toward the junior high school student in developing his understanding of how the managed production system produces and services manufactured goods. Simulated production activities are the core techniques used for many of the learning activities. Actual assembly lines are frequently developed as a part of the learning experience where students who are shareholders in a class-organized manufacturing corporation learn by the manufacturing, packaging, promoting and selling of a product. In addition to the assembly line skills, decision making is emphasized throughout.

In both phases of the Industrial Arts Curriculum Project (IACP) the vocational education motto of "learning by doing" is stressed. Many times this involves a contrived, and/or a role-playing learning program. Individual projects (tie racks, halls trees, cedar chests, etc.) are eliminated; traditional woodworking, metalworking and drafting equipment is frequently moved from the center of the shop area to provide space for the group activities.

### EMERGENCE OF CAREER EDUCATION

The results of these two programs, and many, many similar ones, changed the concepts of many educational leaders as to what elements compose an educational program which is relevant to the students and can meet the criteria of accountability in providing education which meets the needs of boys and girls in the modern society into which they are graduated (or dropped) from school programs. Career education is built around intelligent choice making. Choices are not limited to occupations but are stressed for all components of successful and contented living.

Career education programs are not built in a stereotyped pattern forwarded to the classroom from a central office but

are developed by groups of teachers dedicated to serving the needs of boys and girls through the elimination of the false classifications of academic and vocational lessons, as well as the classifications of general education and college preparatory education.

As groups of teachers develop career educational patterns for local classrooms, areas of emphasis are stressed as teachers plan with students, parents and community leaders to meet student needs. One popular pattern emerging has been the Industrial Arts Career pattern. Sometimes such a curriculum will adopt titles like "Contemporary Living in an Industrial Society" or "Exploration of Technology" or "Home and Industry Partnerships." The titles are of minor importance. Of greater importance are the basic concepts held by the teachers as they direct and execute the planning necessary for such programs as Industrial Arts Career Education.

### CONCEPTS ABOUT INDUSTRIAL ARTS CAREER EDUCATION

The processes involved in Industrial Arts Career Education may be summarized in ten concepts, all worded to begin with the letter "S", and, as such, may be referred to as the "Ten S's of Industrial Arts Career Education".

#### Spiral

The end product of Industrial Arts Career Education is a lifelong series of career approximations and not a final and lifelong career choice. The spiral concept explodes the myth in the mind of the average person that the purpose of career planning is to discover *THE* occupation above all others to which one is best suited. Instead, Industrial Arts Career Education stresses the greater importance for knowing the process of occupational development, including the relation of self to the world of work.

Various educational leaders have identified the segments of the spiral in different manners, but most recommend a process which places those learning activities related to awareness of the world of work in the first grades (K - 6). Such awarenesses usually begin with those occupations affecting the immediate family and home and expanding to include the community,

state, nation and world. This segment of the spiral is usually followed by surveys of careers in grades seven through nine. This segment of the spiral usually includes orientation to careers and the beginning of the concept of clusters of occupations. Pre-vocational learning activities form the next segment of the spiral overlapping those grades nine through eleven. Individual variations in maturity career readiness create the necessity of increased personal attention through intensive guidance and counseling programs with the students, their parents, and their teachers. Instruction should develop as rapidly as possible toward a specialization in the basic skills and knowledge related to a cluster of occupations of interest to the student. College preparatory may be included in this phase of the spiral for those who have indicated definite interests and abilities in careers requiring a university curriculum for entry.

The occupational choice and training segment of the spiral typically comes in grades eleven through fourteen and continues on throughout adulthood. Vocational counseling and guidance will be continued at this level for students, parents and teachers. Freedom to change as a result of careful evaluation and guidance must be available to the student in all segments of the spiral. The final segment of the spiral is related to occupational choice, and training (re-training) is the phase most frequently repeated by the adult following his formal school years.

### **Staff Participation**

Insofar as possible, total school staff participation at all educational levels is necessary for an Industrial Arts Career Education program. Coordinated or Team Teaching opportunities will frequently present themselves as the most advantageous method of effective teaching. If a true spiral effect is to be incorporated in the school system, it will only be the result of the efforts of all the teachers in a school system, including those traditionally thought of as academic or college preparatory oriented as well as those oriented in the vocational and practical arts. The specialized abilities and experiences of teachers, especially those related to occupations and careers, should be used to best serve the needs of students in industrial Arts Career Educational Programs.

## **Student and Teacher Planning**

After teachers have laid the preliminary plans for the Industrial Arts Career Education programs, high priority must be given to the role of the students in planning the final details of the learning experiences with the teachers. The teacher's pre-planning will enable him to lead the class in discussions to formulate group activities and objectives in near concert to his own. Individual conferences will be necessary where students want and have the ability to vary from the group objectives. Although the pre-plan of the teacher will be naturally somewhat adjusted by this process, a teacher worthy of the title can lead the class discussion to incorporate the vital elements of the over-all pre-plan with the student plan. This failing, the teacher should seriously consider the challenge which is presented to his pre-plan and re-evaluate its relevance for the student. Traditionally, many units, sections, or lessons are taught because of the whim of the teacher rather than the need of the student. Such learning is usually forgotten quite rapidly by students.

Student and teacher planning in Industrial Arts Career Education must be declared in measurable objectives to be evaluated and to come under the recent emphasis of educational accountability. Such objectives need to be measured in terms of percentage of achievement. For example, an objective for each student to explore three occupations during the semester might be completed by 90% of the students.

## **Self-Study and Concept**

Industrial Arts Career Education has for its foundation self-study by the student in order to form a clear self concept. Self-study cannot be restricted to the use of standardized tests or pencil and paper tests, but must be broadened to include a continual examination by the student of trends in his own personal development. Students in Industrial Arts Career Education must know who they are, who they want to be, and what they must do to achieve this goal. They should be taught to keep cumulative records of their developments in this area beginning with such file items as their responses to "what could I be" booklets completed in early elementary school.

### Specialized Abilities Utilization

The student's specialized abilities must be given keynote attention throughout the Industrial Arts Career Education spiral of learning activities. All experience, or all lack of experience, can and does affect career development. This concept dictates the necessity of designing learning programs with objectives aimed at helping children and adolescents experiment with a wide range of activities while concentrating part of their energies on the development of their individual specialized abilities. Frequently such experimentation will lead to the discovery of latent and previously unknown special abilities of students. The abilities of creativeness, inventiveness and innovativeness need to be given special opportunities for development through learning activities and less emphasis given to those lessons requiring high intelligence quotients for successful learning.

### Senses

Industrial Arts Career Education involves a combination of the rational and affective processes. There is a direct relationship between thinking and feeling, between learning and the emotional processes. It is most important that many and varied senses be used in an educational program. Traditionally, educators have tended to over-emphasize the sense of hearing. Reading printed pages is more related to hearing than to sight. Hearing is more aptly used as a learning experience when it is used to receive instructions regarding a skill the student desires to master or to hearing the experience of others who know what the student wants to know.

Sight is the sense through which most learning is acquired. Learning experiences must be planned through which the learner observes those things he wants to learn and then sees them again in models, pictures, drawings and diagrams.

The sense of smell and taste are important to educational experiences since many chemicals, foods and other materials are best identified by these senses. Retention is high when learning takes place through these senses.

Touch and kinesthesia are somewhat related and should be included whenever possible in the learning process. Kinesthesia is the touch the student develops in gauging the direc-

tion and amount of muscular effort necessary in manipulative skills. The sense of touch is also used to become aware of texture and quality, smoothness and roughness, heat and cold, and shape. Again, retention of learning acquired through this sense is high.

### Several Media

Career awareness and planning is best influenced by multiple factors. Industrial Arts Career Education will be able to meet this need by having several learning activities available for students. Reading and writing have traditionally been our main media for learning and will continue to be a major one; however, Industrial Arts Career Education should extend both the reading and writing media, beyond books, to include such learning activities as may be brought about through plays, poems, news media, magazines, trade journals, and comics.

Listening is a major media in Industrial Arts Career Education. Listening learning activities may include the use of video tapes, cassette tapes, dialogues with peers, dialogues with tradesmen and businessmen, parents, teachers. Listening may include the re-hearing of a taped presentation by the teacher, guest in the classroom, or a radio broadcast. The art of listening to and retaining for use large volumes of quickly presented audio materials is especially important to upper level Industrial Arts Career Education.

The media of *making* continues to be of major importance in Industrial Arts as it encompasses Career Education. The making learning experiences, however, also include audio-video-taped instructional materials for peers, diagrams, charts and relief maps for communication purposes with peers and others. Closely akin are the *doing* learning experiences which include investigations, role playing, academic games, problem solving. The computer and its programing presents a real possibility for presenting learning activities for these areas.

### Special Projects and Activities

Industrial Arts Career Education is best taught through the use of many projects and activities, few of which involve the entire class. Small groups of students, or individuals, un-

dertake planned learning activities of interest to them. After the completion of the project or activity they share their learning experience. Peers also learn from this activity and many times discover latent interests and abilities by their increased awareness. There are few worthwhile field trips of such general interest that the entire class should participate. Likewise, few outside speakers will appeal to an entire class. These learning procedures are best handled through special projects and small group or individual activities in Industrial Arts Career Education.

### **Small Group Processes**

Active participation by students in Industrial Arts Career Education is increased by a variety of learning experiences. Small group processes are necessary to bring this variety to the program. All students learn better when their curriculum is individualized. A term sometimes applied to this process is called "packaging of learning activities." Admittedly it takes time and planning at the outset on the teacher's part. Individualizing is more difficult in classes overloaded beyond the optimum teacher-pupil ratio. However, once teacher planning is completed, the teacher is rewarded by the opportunity to know students more individually and by having students accept more responsibility for the individualized instruction. As students use more self instruction, they develop an awareness of the intensive rewards of learning thereby developing a greater love for learning as a *fun* activity. This process also develops the self concept of the student—one of the major aims of Industrial Arts Career Education. More opportunities for creativity and direction of purpose on the part of the student are also provided. Small group processes in Industrial Arts Career Education further generate enthusiasm among students because of the successful termination of each learning package attempted by the student. Success is the key to positive self concept.

### **Services of Community**

The community is the best laboratory for Industrial Arts Career Education. Local businessmen create a great love and

respect for their local school program and will go to great lengths to support it. Local business frequently responds to the needs of the school in their community by providing training stations, giving opportunities for youth to explore occupations, learn skills, become acquainted with trade and union activities.

### SUMMARY

Why change to a K - 12 system of Industrial Arts Career Education? It should be done only if teachers and administrators have the courage to change, have the courage to decide that education is for the student as he learns to make choices which meet his present needs. The process of decision making becomes paramount with subject matter only as a tool to be used in making wise choices. Learning becomes a responsibility of the student, a process enjoyable to him, one planned in cooperation with his teachers. Teachers and administrators find that Industrial Arts Career Education gives them more time to fill their role of counseling (usually in small groups or individually), to be a diagnostician, to function as a facilitator, to be most importantly of all a friend to the student, and lastly but not leastly, a teacher.

SECTION IV

**Senior High School  
Industrial Arts Programs:  
A Study of Industry**

## CHAPTER SEVEN

# The Role of Industrial Arts in the Senior High

*John Mitchell, Chairman  
Department of Industrial Education and Technology  
University of Maine at Portland-Gorham*

Industrial arts in Maine rests on the premise that technology and its prime user, industry, form a cornerstone in the success and future of man and society.

An early bulletin from the State Education Department in 1918 reads:

The controlling purpose in this work (manual training) should give the pupils a broader insight into the various industries through participation in the various activities which make up the industrial life of the country; to provide more extensive opportunities in educational activities to meet the individual interests and aptitudes of the student body; and to direct the students along such branches of occupations for which they may be best fitted. (31: p. 2)

In the senior high school, it continued:

The general industrial course does not aim to prepare the student for a specific occupation, to be a skilled workman . . . but to give the student a definite basis for appreciating and recognizing values in various industrial fields. (31: p. 11)

### THE MAINE PLAN

The Maine State plan is supported by a philosophy not unlike that which prompted the 1918 statement, the Richards' pronouncement, the Bonser theory or the other post-Sputnik curri-

culum innovations that have since dotted the industrial arts educational spectrum. It is uniquely suited to its schools, pupils and geographic setting, all of which have molded and shaped its progress since 1960.

### **Background**

The circumstances surrounding the plan's development may be traced to two educational innovations, the junior high school and the general shop, and to a State law which mandated certain curriculum requirements at the high school level for "occupational courses." The advent of the junior high school shortly after the turn of the century brought with it an emphasis on exploratory function and the need for a diversity of experiences, especially in the 'manual arts.' The single area shops, which dominated the high school programs of that era, found their way into the lower levels and notably in the larger school systems which were able to provide several of these shops to permit boys to rotate through each one over a semester or year. Small communities and school systems, on the other hand, which could ill-afford more than one shop and one teacher were left to their own resources to provide whatever diversity could be achieved in their programs. Thus, the concept of the general shop was born but several years passed before it took root nationally. In Maine, with its preponderance of small school systems, it was greeted with skepticism at first, and then enthusiasm. It should be noted that since there were relatively few junior high schools in the state, the comprehensive general shop idea which emerged found most of its support at the high school level.

### **Occupational Industrial Arts**

It was an action of the State Legislature, in 1945, that not only strengthened the place of industrial arts in the curriculum, but the comprehensive general shop as well. It amended an existing law concerned with "occupational courses" to make it possible for any youth to enroll in an industrial arts program in another school, if it were not provided in his own. Before it could accept tuition, moreover, the receiving school had to offer at least two of the following approved "occupational courses": agriculture, business education, distributive education, home

economics, or industrial arts. The law further stipulated that a program to be approved must meet certain standards of sequence, scope, time, space and equipment. Four areas of major industrial activity were prescribed for industrial arts: woodworking in its more important phases, metalworking, electricity and internal combustion engines or power mechanics. (12: p. 7)

The implications of the amended law were far-reaching and extended to most of the secondary schools in the state and to the teacher education institutions. The industrial arts program at Gorham State Teachers College, in 1947, was completely restructured to give priority to the required technical areas and to the organization and methodology of the comprehensive general shop.

A curriculum guide was prepared in 1954 by the Maine Association for Industrial Education and it was subsequently approved by the State Education Department for "occupational industrial arts." It identified the objectives and content for the four major areas at three levels, assuming that pupils could enter at a level commensurate with their background. The content was primarily an analysis of each of the subject matter areas in terms of operations, processes and related information. Suggested projects or activities were listed to encourage implementation of the objectives. (22)

Teachers of comprehensive shops with very small classes or those with adequate facilities for a whole class in one area used the guide successfully. The majority, however, found little help in the content, since they were forced by circumstances to divide each class so that an equal number could be accommodated in each of the four areas. After a specified time, the groups would rotate so that by the school year's end, all areas were experienced by the pupils. Needless to say, the problems inherent in such a process led to a disenchantment with the comprehensive general shop and consequently, a deterioration in the purposes it was to serve. The recommended rotation method made the "canned or assigned" project a major activity and any attempt to include information not directly concerned with its production or service met with rebuff. As time passed, it was not unusual to find implementation of the diversified program and the fulfillment of its general education objectives lost in the technical strengths of the teacher.

## A New Curriculum Guide

A chain of events early in 1960 had a significant impact on industrial arts in Maine. Dr. James B. Conant's report, in 1959, on the American high school (9) brought with it an examination of the junior high school curriculum and a call to educators by the State Education Department to develop a guide to learning for grades 7, 8 and 9. The Industrial Arts Department at Gorham was asked to furnish the content for the industrial arts section. After long hours of deliberation, it was decided to develop a 6-year curriculum which would provide a continuum from grades 7 through 12. The comprehensive general shops that already existed in the state would provide the setting, since it was still felt that these were most ideally suited for conducting the program and would most effectively fulfill the general education objectives of industrial arts. This view was equally shared by others, notably Dr. G. Wesley Ketcham, State Consultant for Industrial Arts in Connecticut, who wrote in a later issue of *School Shop*:

The very nature of the general shop, if properly equipped and organized, makes it unique in its potential for fulfilling the breadth and depth of learning that is stated and implied in the definition of industrial arts. It alone, of all the industrial arts organizational patterns, can provide the flexibility of physical environment and instructional procedures which are so sorely needed to open new vistas of technological know-how. (18: p. 77)

A personal interest in the "resource unit" (24) early in 1952 as a means of developing curriculum content which could be included in these shops or laboratories led to the teaching unit and, with some modification, to the unit method of course organization and instruction. Since the word "unit" is notorious for a multiplicity of meanings, an explanation of what it is and how it is used will make more meaningful the Maine curriculum plan.

## The Unit

The unit is a collection of instructional activities and materials organized around a central idea or theme to help the learner develop certain understandings, skills and attitudes related to industry and technology. (1: p. 87) The work of a semester or year is usually divided into a series of these units which are interrelated, each having a unifying element toward which

the activities and learning experiences are directed. The unit used in this context is not centered around a material, as wood, metal, plastics nor around specific machines, tools, processes or the like; nor is it a chapter or topic in a book, or the title of a lesson; further, it does not involve piecemeal learning of unrelated, isolated skills or facts. The characteristics of the unit do include the following:

1. It is flexible in time, longer than a single period, but not as long as a semester. It must be long enough, however, to accomplish the objectives selected.
2. It provides readily for individual differences in a class, permitting the slow, the dull, or the bright pupil to find and achieve his level of success by using the abilities he possesses to implement the unit objectives.
3. It is flexible in content and adaptable to any grade level. Since the basic concepts and skills related to the central theme provide only the direction, the activities within its framework may be as varied as the pupils, the teacher, and the facilities permit.
4. It is adaptable to modular or flexible scheduling or mini-course requirements since it is a complete learning package in itself. While the pupil may gain greater insights and improve his abilities with each additional unit, his experiences in one unit should provide some basis for understandings and skills in developing his self-concept.
5. Several units within a specific course can be made progressive; that is, each succeeding unit may build on a prior one so that not only reinforcement will take place, but greater depth as well as breadth of understandings and skills can be realized.
6. In a general laboratory, of whatever type, the unit crosses arbitrary dividing lines between areas and concerns itself with the concepts, skills, and values of the central theme. For example, in a general metals laboratory, a unit on the "Home-workshop Tools and Accessories Industry" involves the areas of sheet metalwork, casting, heat treatment, forging, machining and finishing. The selection and manufacture of a tool or accessory can involve all these areas. In the unit, they are not taught separately; rather, the concepts or skills common to all the areas are taught

in their logical sequence. The pupils can then perceive the relationships that exist and utilize whichever areas, tools or machines in the laboratory will accomplish the task or solve the problem at hand.

7. In the unit, the basic understandings, skills, and attitudes pertinent to the theme must be identified and pursued to the end that observable and measurable behavioral changes are evident in the pupils.

It should be made clear that in a comprehensive general laboratory, all the pupils must be engaged in the *same* unit while that unit is in progress to eliminate the problems which have plagued the rotational plan, but more importantly, to make instruction and learning more effective.

### Unit Themes

The selection of unit themes, their relative place in the total curriculum and their validity as subject matter acceptable within the State's legal requirements presented a challenge. The efforts of Hammond (14: p. 14-20) and the experimental units tried at Fitchburg State College in the early fifties suggested several themes, as "Novelties in Graphic Arts," "Games and Sports Equipment," "Home and Household Accessories," to name a few. These were significant in identifying not only pupil needs and interests but also proved that such units could be effective in teaching about technology. Nonetheless, it was difficult to justify a total curriculum based on such unit themes without violating the State's mandate.

A major breakthrough came with the publication in 1957 of Olson's research "Technology and Industrial Arts" (26) by Epsilon Pi Tau fraternity. As an extension of its precursor, the bulletin, "A Curriculum to Reflect Technology," (33) published earlier in 1947, a structural framework adaptable to Maine's needs was provided. The broad industry categories of Manufacturing, Construction, Electrical-Electronics, Power and Transportation, and Service outlined in these publications could, with some modification, be acceptable within the existing industrial arts curriculum requirements and laboratory facilities. It was here that the unit concept and themes made implementation possible. From those suggested by Hammond, and others derived

- Title of Unit* (State the central theme or unifying idea with which the class will be concerned.)
- Introduction* (State briefly why the industry or theme is important and of particular interest to pupils.)
- Scope* (Indicate for whom the unit is being prepared—grade level, ability or background of pupils, approximate time or other limitations or considerations.)
- Objectives* (State simply and clearly the specific objectives of the unit, one for each of the following: understandings, skills and attitudes. Use separate page for each one. In three columns under each objective, include:
- Expected Behavioral Outcome* (Analyze each objective in terms of expected terminal behaviors which will be evident or acquired if the objective is achieved.)
  - Suggested Lessons* (Indicate title of lesson(s) which may be taught to help implement the behavioral outcome. Note if concept or skill.)
  - Suggested Instructional Strategies* (For each behavioral outcome, list suggested *pupil* activities, problems, assignments, methods or techniques that will help achieve the desired outcome. Be specific. Consider basic activities which *all* pupils should have, but include optional ones to provide for individual differences.)
- Approach* (List ways of getting pupils interested in the theme or getting the unit under way. The approach should be realistic and achievable.)
- Resource Materials*
- Reference and Research Materials* (List those readily available for either teacher or pupil use and relevant to the unit. Use full bibliographic entry.)
  - Instructional Media* (List any chart, model, instruction sheet, film or other aid which would be useful in facilitating learning. Be specific. Use exact titles, sources and costs, if any.)
- Tools and Equipment* (List *special* tools or equipment needed to carry on unit.)
- Materials and Supplies* (List only materials and supplies necessary or unique to the unit theme.)
- Lessons to Be Taught* (State titles of all lessons to be taught, arranged in as logical a sequence as possible. See suggested lessons under each objective.)
- Unit Evaluation* (Indicate techniques by which unit objectives (terminal behaviors) may best be measured or evaluated, as objective test, observation, performance test, oral reports, etc. and prepare an instrument with specific questions or items to be used. This should be prepared as the unit progresses or before.)

Figure 1. Unit Plan Guide.

from the Standard Industrial Classification Manual (32), themes representative of industries were identified which could be included under each of the major categories. These were then analyzed, using a Unit Plan Guide (similar to Figure 1), and the content was organized so that each industry could be studied and explored in its entirety. Since each unit attempted to simulate an industry, its scope included those limitations which would provide some measure of control and direction.

A six-year program, starting at the 7th grade, was developed and the categories arranged with consideration for purposes, facilities, pupil needs and interests, and mental and physical abilities. The results of a year-long pilot program (2: pp. 18-21) affirmed the viability of the overall structure and the unit approach devised for implementation. Inadequacies in the teacher's preparation and in the availability of resource materials were revealed but these have been improved measurably since inception of the program state-wide in 1965.

### **Curriculum Outline**

A closer look at the curriculum outlined in the State Guide, "Industrial Arts Technology, A Study of American Industry" (23) which was prepared by selected teachers, will provide a better picture of all the major industry classifications and the units suggested for implementation. (Figure 2) Focus will then be made upon the high school program to reflect changes which must be considered as its second decade of use approaches.

Manufacturing occupies a seemingly dominant role in the curriculum because of the variations in scheduling industrial arts in the schools of the State. Pupils will have an opportunity to experience manufacturing at any level through the tenth grade. The enclosed numbers indicate the approximate duration of the units in weeks. Some progression and increase in scope or depth of understandings and skills is implied in each unit on the assumption that the pupils will be enrolled for the full six years. However, since it is not uncommon to have pupils enter or leave at any point along the continuum, especially below the 10th grade level, provision is made for flexibility within the units themselves and in their selection for use with a particular class. This is accomplished through the general objectives of each unit, which are similar except for the name or type of industry

*Grade VII*

## MANUFACTURING INDUSTRIES

Units:	Technology and Civilization	(1)
	Household Accessories	(8-9)
	Personal Accessories	(8-9)

*Grade VIII*

## MANUFACTURING INDUSTRIES

Units:	Camping Equipment	(6-9)
	Hunting and Fishing Equipment	(5-7)
	Communication Equipment	(5-8)

*Grade IX*

## MANUFACTURING INDUSTRIES

Units:	Tool and Home Workshop Equipment	(9)
	Small Furniture for the Home	(10)
	Production Industries (Mass Production)	(9)
	Model Power Products	(8)

*Grade X*

## MANUFACTURING AND CONSTRUCTION INDUSTRIES

Units:	Tool and Machine Industries	(12-15)
	Residential Construction	(18-20)
	Transportation Construction	(3-4)

*Grade XI*

## POWER AND TRANSPORTATION INDUSTRIES

## ELECTRICAL-ELECTRONICS INDUSTRIES

Units:	Thermal Power	
	a. Portable Power Plant Industries	(6-9)
	b. Transportation by Automobile	(6-9)
	Residential Wiring	(3-6)
	Wire and Wireless Communication	(12-18)

*Grade XII*

## SERVICE INDUSTRIES

Units:	Small Service Business Management	(2)
	Appliance Servicing	(7-11)
	Automotive Servicing	(6-9)
	Repair and Refinishing Industries	(3-5)
	Area of Specialization	(18)

(vocational orientation)

(The student may choose 18 weeks in any of the following industries: Manufacturing, Construction, Power and Transportation, Electrical-Electronics or Service)

*Grade XII*

(Optional)

Units:	Area of Specialization (vocational orientation)	(36)
	(The student may choose 36 weeks in any of the major industries listed above)	

Figure 2. Suggested Industrial Arts Curriculum\*.

\*Maine State Education Department, *Industrial Arts Technology: A Study of American Industry*, pp. 6-7.

being studied, and the analysis of these objectives in behavioral or performance terms. The latter are critical in determining the pupils' status within each major classification.

The units for the Electrical/Electronics Industries and the Power/Transportation Industries at Grade 11 proved most difficult to identify since they involve, in large measure, a study of principles and theories with applications that are more service than product oriented. Nevertheless, the suggested units have been utilized with varying degrees of success.

### **TOWARD A REVISED CURRICULUM**

Industrial arts in Maine, especially at the high school level, has been in the maelstrom of educational change since the inception of its technology curriculum. Many of the smaller secondary schools where industrial arts played an important role were phased out and merged into larger school administrative districts where more than one laboratory and one teacher were needed. With vocational education assuming a more important role after the passage of the Vocational Education Amendments of 1963 and 1968, area or regional vocational centers at the high school level were added and began to draw 11th and 12th grade pupils to their programs, reducing enrollments or even eliminating industrial arts in these grades at the feeder schools. The addition of secondary vocational-technical institutes to serve all major geographic areas in the state opened other avenues and alternatives to higher education. The construction of a new Industrial Education and Technology Center at the University and the implementation of revised undergraduate and graduate programs to prepare and up-grade teachers for both industrial arts and vocational industrial education have given greater impetus to program improvement. More recently, the interest in career education at all school levels has added another dimension to the role which industrial arts should play. Other national and local educational and socio-technological concerns have invaded school curriculums and have been accepted in varying degrees.

#### **Assumptions**

The basic assumptions, nevertheless, which are still relevant and underlie the projected curriculum revision for Maine high schools remain as follows:

1. Since we are living in a highly technological culture, brought about by scientific discovery and invention, and made available and useful to mankind through the technology of industry, it follows that a study of industry is essential in the basic education of all youth if they are to better understand and cope with technology and its effects upon society.
2. Industrial arts, conducted in a laboratory-classroom environment, is ideally suited for the study of industry since a variety of activities and experiences which represent the many facets and functions can be simulated.
3. The industrial arts high school curriculum must have sufficient breadth to give every youth an opportunity to continue his search for whatever talents he may possess, yet include sufficient depth to provide a pre-vocational orientation for others. In addition, it should be sufficiently flexible to permit any youth in the school an opportunity to satisfy technical needs or interests.
4. An effective industrial arts curriculum must be organized to provide a continuity of instruction based upon sound principles of learning which recognize individual differences in the needs and interests of youth.

## Objectives

The general objectives which have been accepted to provide the direction for this revision may be centered around the major concerns of all education; namely, the development of understandings, skills and attitudes or values for successful living. Those that are uniquely identified with industrial arts may be simply stated as follows:

1. To develop an understanding of industry and technology and their effects upon man and society.
2. To develop skill in the use of industrial tools, instruments, machines, materials, equipment and related processes in solving technical problems and identifying technical talents or occupational interests.
3. To develop desirable attitudes toward work, the worker and the products and services of industry.

All other objectives can be classified or subsumed under these three or may be concomitant or learned incidentally during the program.

The advent of the school administrative districts, with larger and more comprehensive high schools, and the regional vocational centers, which are a part of some of these schools, necessitated changes in the physical planning of industrial arts laboratories and restructuring of the curriculum. Where only one teacher and laboratory still exist, however, full implementation of the curriculum will be limited by the instructional resources available.

### **Facilities**

Three laboratories representing the major industry classifications will be needed to provide the desired learning environment. These are: Manufacturing/Construction; Energy/Transportation; and Graphic Communication. Each laboratory represents industries and technologies which are closely related; involves common concepts and skills; includes and utilizes equipment and materials that may be shared; and more importantly, maintains the advantages of unit organization and teaching. Graphic Communication, which comprises all that was formerly called graphic arts and graphics (drafting) did not appear in any previous guide, nor were either of its components among the mandated subject areas. Drafting was generally assumed to be a part of project planning, hence it did not require separate identification. Graphic arts, which was primarily printing, was not included because of abuses in several schools. In the present guide, graphics is a part of each unit to orient the pupils to one of the engineering functions. In the projected curriculum, graphic communication will still serve the latter purposes but will be expanded to give additional insights to the industries and technologies involved.

The Service Industries which occupy the senior year may continue to do so by including pertinent units for study in each laboratory. Another alternative can involve the vocational centers which may be solicited to accept seniors for an in-depth study of one or more of these industries.

Those pupils who have made serious occupational decisions should be given the opportunity to enroll in vocational programs at the upper levels. However, they should not be excluded from further industrial arts experiences if their decision proves unwise.

## MANUFACTURING INDUSTRIES

Suggested Units: Introduction to Technology

Personal Accessories (Costume Novelties)

Home Accessories

Sporting and Athletic Equipment

*Grades  
VII & VIII*

	MANUFACTURING /CONSTRUCTION	GRAPHIC COMMUNICATION	ENERGY/ TRANSPORTATION
<i>Grade IX</i>	Toys and Games (Production) Model Power Products	Paper Making Industry Packaging Greeting Cards	Energy Systems Electronic Hobby Products
<i>Grade X</i>	Residential/Commercial Construction Transportation Construction	Small Structure Design Commercial Forms Signs & Advertising Displays Reproduction Systems	Electrical Construction Tele-Communication Land Transportation

## OPTIONS / VOCATIONAL

<i>Grade XI</i>	Furniture for the Home Tool & Machine Prefabricated Structures	Product Illustration Publications Photocopying	Instrumentation & Controls Air Transportation Marine Transportation
---------------------	---	--	--

## OPTIONS / VOCATIONAL

*Service Industries*

<i>Grade XII</i>	Furniture Repair & Refinishing Building Repair Tool Sharpening & Repair Antique Repair & Restoration	Servicing Office Reproduction Equip. Servicing Small Reproduction Machines	Automotive Servicing Small Engine Servicing Appliance Servicing Electrical Repair Service
----------------------	--	--	---

Figure 3. Projected Industrial Arts Curriculum for Maine.

## The Curriculum

The basic industrial arts curriculum projection for the secondary schools in Maine appears in Figure 3 and provides both a perspective and direction for full implementation. The significant increase in the number of 7th and 8th grade industrial arts programs since the mid-sixties makes a restructuring of the total curriculum necessary, if the desired senior level program is to be made possible. Consideration is given to four-year high school programs, since these are the dominant types in the State.

The units listed under each industrial classification are tentative and suggestive of those which seem pertinent for study. Teacher teams in each school should develop their own series to reflect local needs and concerns, and to determine the time limits allotted each one.

Since the pupils entering grade 9 may not have experienced all the major types of industries, their first and second years should include units in each of the three major laboratories to help them gain additional insights before making any occupational decisions. The length of time they will spend in each laboratory will be determined by the number of pupils enrolled in the whole class and the stations available. Smaller classes will benefit in this regard. At the close of the sophomore year, if they elect to continue in the program, they should be given the option of selecting one or more industries to pursue, within the limits of enrollments and scheduling.

Where the industrial arts programs are curtailed or enrollments diminished at the 11th and 12th grades to permit vocational preparation at a regional center, provisions should be made to continue the basic program for the regular pupils. Other pupils should be encouraged to participate by including industrial arts courses or units in their programs on a pass-fail or other option. Teacher-pupil planned units may be developed around topics of special interest to these pupils and conducted at mutually acceptable times. Similarly, mini-courses or units designed around consumer or socio-technological concerns may be offered. Examples which may suggest others include: Home Maintenance; Consumer Car Care; Environment, Technology and You; or The Products We Buy.

Advanced pupils may be given an independent study option in any technical area of interest. A negotiated 'contract' may be used to affirm the terms of study and the completion date.

### **The Unit**

The Unit Teaching Model, Figure 4, shows the relationship of the components. In the model, "terminal behaviors" refer to performance outcomes which will be observable and measurable at the conclusion of the unit. "Second level behaviors," on the other hand, are derived from either a task or content analysis of an identified lesson and contribute to the achievement of the terminal outcome.

The scope of the total curriculum and the suggested content of the units are graphically portrayed in Figure 5. To accomplish the objectives of the units at any level, one or more concepts and skills listed under each of the five major industrial functions should be included. Not all information pertinent to these can be taught in a single unit. However, a series which has been sequentially developed can provide new and deeper insights to each function so that at the conclusion of several units, a pupil will find the functions more meaningful in his career aspirations.

### **Strategies**

The instructional strategies and methods for implementing the units may be suggested or indicated in the unit's scope or reflected in the stated behavioral outcomes. The unit is most flexible in this regard. It permits pupils to role-play or simulate different types of industries, organizations and functions such as sole proprietorships, partnerships, and corporations; engage in custom, job lot or mass production; do servicing; practice research and development and engineering; study personnel administration; and experience finance and marketing. Individualized learning packages related to the functions may be used on an individual or independent study basis. Resource persons, single-concept films, closed-circuit television, audio and video tapes, among other educational technology, may find use, limited only by availability and the teacher's resourcefulness. The "live"

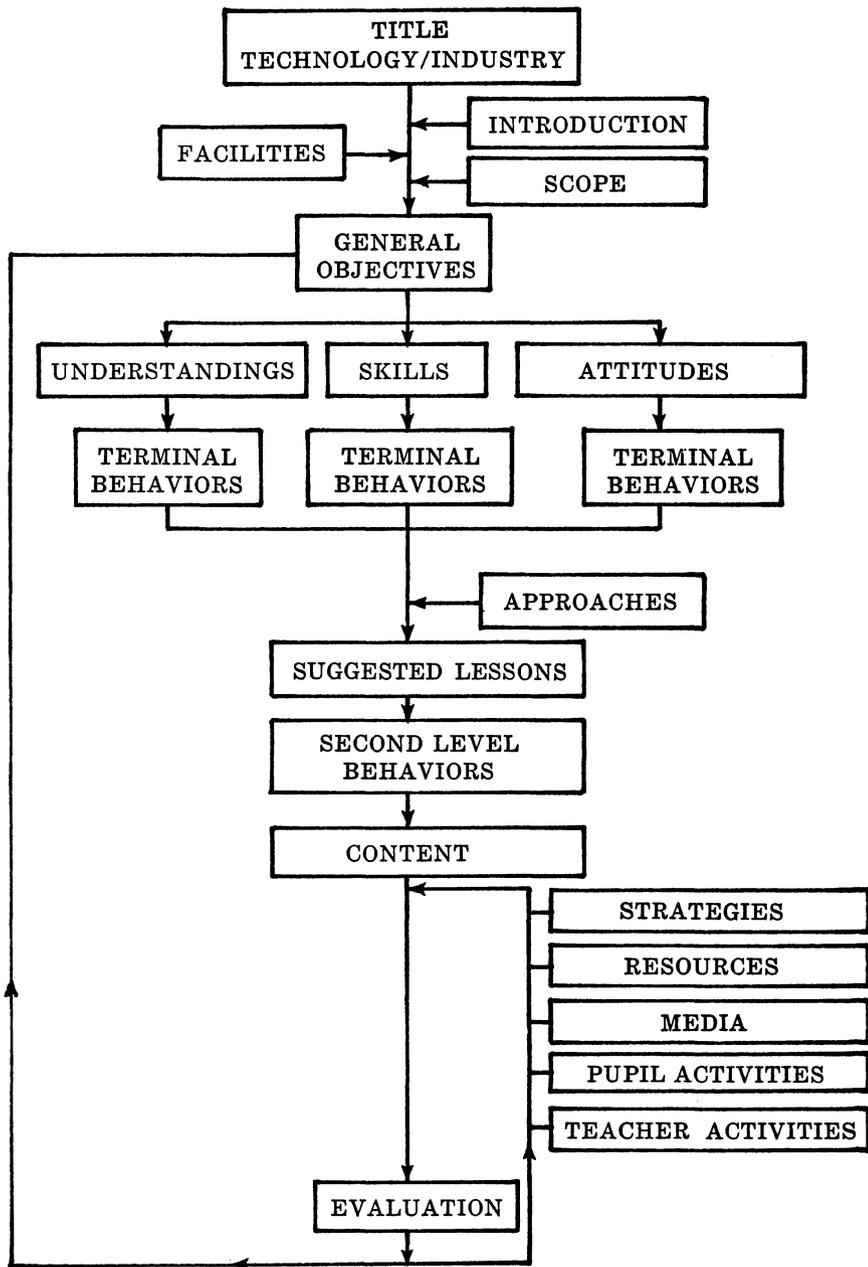


Figure 4. Unit Teaching Model.

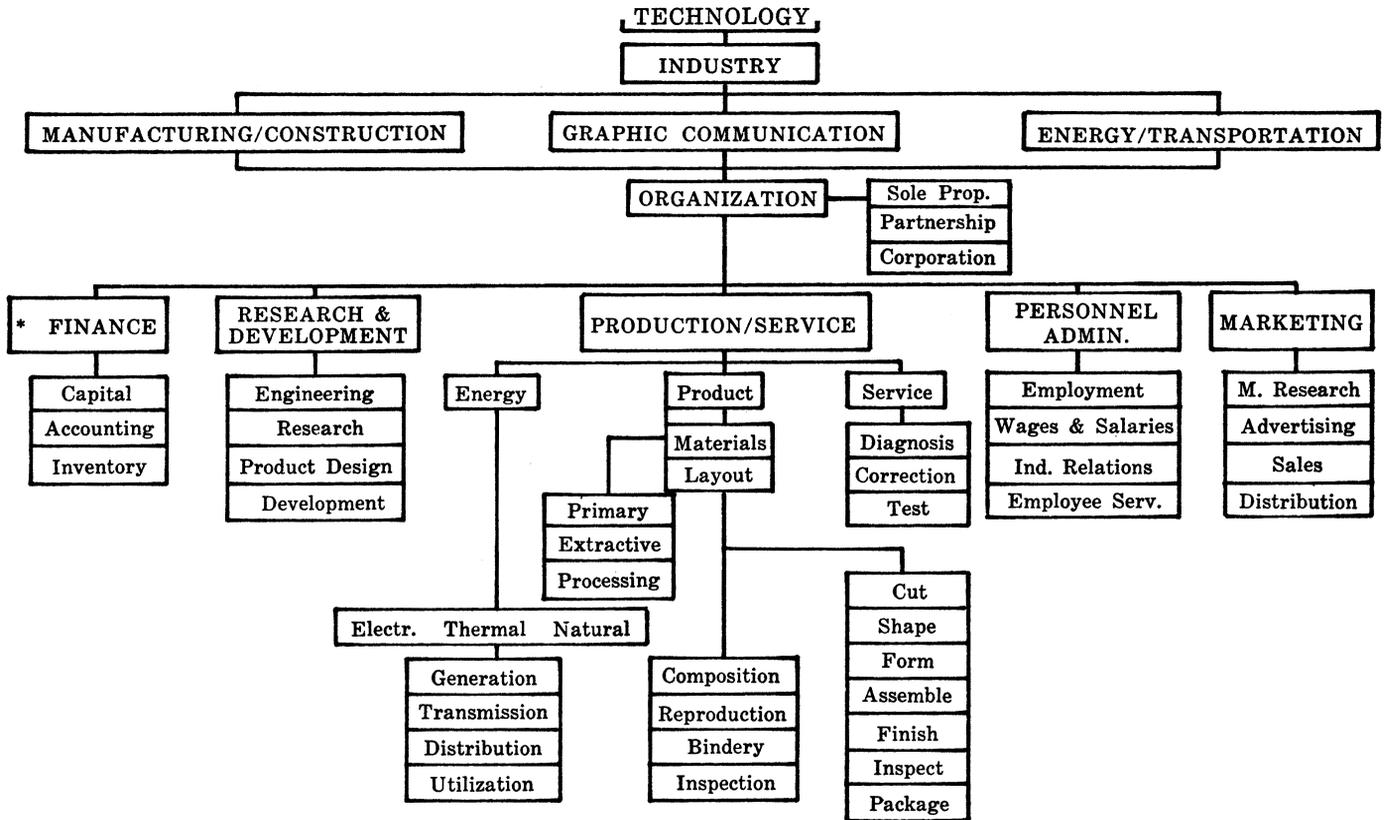


Figure 5. Scope of Curriculum and Content of Units.

\*Functions adapted from (4)

demonstration, followed by "hands on" activity will remain one of the most effective strategies for learning psychomotor tasks.

### **Evaluation**

The most effective evaluation of the proposed curriculum will be rendered by those who, having participated and completed all the requirements, display competency in the behaviors established for each course and unit. This implies a long-range procedure which, though possible, may not be feasible. In that event, the teacher must utilize the most valid and reliable techniques at his disposal. These include objective and performance tests, observations, assignments, oral reports and the like. The terminal objectives of each unit provide a valid basis for selecting the measurement devices and evaluation techniques.

Cognitive outcomes, by and large, will require written or oral reporting instruments. Objective tests which include recognition, alternate response and recall items in their various forms should be considered to the extent they measure the behaviors sought.

Psychomotor or skill outcomes may be measured by performance tests. The difficulties in administering such tests to a class or group, however, limit their general use in industrial arts classes. Careful and objective observations of pupils while performing skill tasks related to the unit can provide an evaluation of the learning that has taken place.

Affective or attitudinal outcomes are usually difficult to assess because of possible biases and personal values of the teacher. In a laboratory environment, nevertheless, specific attitudes relating to safety, respect for property, care of equipment, cooperation and others are a serious concern of the teacher and must be evaluated. Observations of the pupils' activities, actions and comments help provide valid evidence.

In sum, then, evaluation of the curriculum can be directed at the pupils' understandings, skills and attitudes, analyzed in performance or behavioral terms and included in the units of every laboratory course. To be valid and reliable, the techniques used must be appropriate to the behaviors being sought in each pupil. The ultimate evaluation, however, must await the passage of time when only the individual's competency will reveal the success of the curriculum.

## A Concluding Statement

Industrial arts in the senior high schools of Maine, as elsewhere, has been seeking a new image and focus. Although pressured by vocational education, career orientation and preparation, it has attempted to satisfy the needs and interests of all youth within the limits of its potential and resources. The proposed curriculum, like its predecessor, must face the test of time. Its survival rests with those who use it and after recognizing its shortcomings, take pen in hand and alter its direction toward the goals all education seeks.

## SELECTED REFERENCES

1. Alcorn, Marvin D., et al, *Better Teaching in Secondary Schools*. New York: Holt, Rinehart and Winston, Inc., 1964.
2. Alexander, William F., "What About Technology in the Industrial Arts Program?" *Industrial Arts and Vocational Education*, October, 1963.
3. American Council of Industrial Arts Supervisors, *Industrial Arts Education*. Washington, D.C.: American Industrial Arts Association, 1963.
4. Association of Consulting Management Engineers, *Common Body of Knowledge for Management Consultants*. New York: The Corporation, 1957.
5. Banathy, Bela H., *Instructional Systems*. Belmont, Calif.: Fearon Publishers, 1972.
6. Berry, Arthur O., "Analysis of Selected Manufacturing Industries as a Basis for Course Content in Industrial Arts." Unpublished Doctoral Dissertation. Storrs, Conn.: The University of Connecticut, 1967.
7. Billett, Roy O., *Teaching in Junior and Senior High Schools*. Dubuque: William C. Brown Company Publishers, 1963.
8. Bruner, Jerome S., *The Process of Education*. Cambridge, Mass.: Harvard University Press, 1967.
9. Conant, James B., *The American High School Today*. New York: McGraw-Hill Book Company, Inc., 1959.
10. DeCecco, John P., *The Psychology of Learning and Instruction: Educational Psychology*. Englewood Cliffs, N.J.: Prentice Hall, Inc., 1968.
11. DeVore, Paul W., *Structure and Content Foundations for Curriculum Development*. Washington, D.C.: American Industrial Arts Association, Monograph, n.d.
12. Division of Vocational Education, "Standards for Occupational Courses." Augusta, Me.: Department of Education. Mimeo Letter, February 15, 1954.
13. Gronlund, Norma E., *Stating Behavioral Objectives for Classroom Instruction*. New York: The Macmillan Company, 1970.

14. Hammond, James J., "The Unit Method of Teaching at the Junior High School Level," *The Unit Method*. Washington, D.C.: American Industrial Arts Association, 1960.
15. Hoover, Kenneth H., *Learning and Teaching in the Secondary School*. Boston: Allyn and Bacon, Inc., 1968.
16. Industrial Arts Department, *A Guide to Learning in Industrial Arts*, Preliminary Draft. Gorham, Me.: The Department, Gorham State College, 1960.
17. Kemp, Jerrold E., *Instructional Design*. Belmont, Calif.: Fearon Publishers, 1971.
18. Ketcham, G. Wesley, "Retooling the General Shop," *School Shop*, April, 1967.
19. Kibler, Robert J., Larry L. Barker, David T. Miles, *Behavioral Objectives and Instruction*. Boston: Allyn and Bacon, Inc., 1970.
20. Lauda, Donald P., Ed., *Technology, Values and Education*. Terre Haute, Ind.: School of Technology, Indiana State University, 1971.
21. Mager, Robert F., *Goal Analysis*. Belmont, Calif.: Fearon Publishers, 1972.
22. Maine Association for Industrial Education, *Curriculum Guide: Industrial Arts in Maine*. Gorham, Me.: The Association, 1954.
23. Maine State Education Department, *Industrial Arts Technology: A Study of American Industry*. Augusta, Me.: The Department, 1965.
24. Mitchell, John, "The Resource Unit in Industrial Arts Teacher Education," Panel Report. Atlantic City: National Association of Industrial Teacher Educators, American Vocational Association, 1955.
25. Olson, Delmar W., *Industrial Arts and Technology*. Englewood Cliffs, N.J.: Prentice Hall, Inc., 1963.
26. ...., *Technology and Industrial Arts*, Published Doctoral Dissertation. Columbus, Ohio: Epsilon Pi Tau, Inc., 1957.
27. Popham, W. James and Eva L. Baker, *Systematic Instruction*. Englewood Cliffs, N.J.: Prentice Hall, Inc., 1970.
28. Schmitt, Marshall L., *Improving Industrial Arts Teaching*. Washington, D.C.: U.S. Office of Education, 1962.
29. ...., and Albert L. Pelley, *Industrial Arts Education*. Washington, D.C.: U.S. Government Printing Office, 1966.
30. Silvius, G. Harold and E. H. Curry, *Managing Multiple Activities in Industrial Education*. Bloomington, Ill.: McKnight & McKnight Publishing Company, 1971.
31. State Department of Education, *State Aid to Schools—Industrial Education*. Augusta, Me.: The Department, 1918.
32. The Technical Committee of Industrial Classification, *Standard Industrial Classification Manual*. Washington, D.C.: Office of Statistical Standards, Government Printing Office, 1957.
33. Warner, William E., *A Curriculum to Reflect Technology*. Columbus, Ohio: Epsilon Pi Tau, Inc., 1947.
34. Wittrock, M.C. and David E. Wiley, Eds., *The Evaluation of Instruction*. New York: Holt, Rinehart and Winston, Inc., 1970.

# **The Orchestrated System**

## **Focus Upon Industrial Arts**

### **for the Senior High School**

*Lewis W. Yoho*  
*Dean, School of Technology*  
*Indiana State University*

Accurate assessments of the alternatives for high school Industrial Arts demand scholarly debate to reveal meaningful differences and real advantages for learning. Observations of the advocated physical activities are not likely to reveal great differences helpful for assessing real values and for making program decisions. A focus from the Orchestrated Systems theory will seek to penetrate some of the important differences in order to isolate the issues and critical alternatives deserving debate and study.

#### **FOCUS UPON FOUNDATIONAL ALTERNATIVES**

The identification of the appropriate point of origin or basic foundation for Industrial Arts remains an issue for debate. Granted that the physical activities may appear quite the same whether the focus is upon the industry, the economic system, the technology, or the human being; from the Orchestrated Systems focus a precise distinction at this basic point can make a tremendous impact advantageous to learning and program development.

Strategy for man's enterprising, his education, and his growth and development logically should develop from his purpose for existing. Failure to face this most difficult question regarding human purpose leads to inconsistencies and dichotomies which are identifiable in present practices. Man's fulfillment is education's primary objective but we cannot consciously and logically plan for man's fulfillment in absence of knowledge and commitment regarding his purpose. Possibly the question is not too difficult, for the human being has a unique capability for personal introspection. He is able to know fulfilling experiences. He cannot escape the motivated feelings that accrue from positive contributions resulting from meaningful participation or creative action. Corporate man is still pushing on the frontiers, exploring the moon, moving further into outer space, probing the depths of the oceans and the core of the earth. Man is making a difference; he is a creator by purpose. Man creates under conditions of probabilities and struggles toward optimization but he is an imperfect creator, an instrument for the continuing creation, living and struggling with his errors and failures but also experiencing fulfillment through his successes. The exercise of his talents generally yields a margin of profitable advance.

Many educators and scholars have recognized the human being as a creator but the impact is not widely evident. Ralph W. Tyler, (10: pp. 25-28) writing in the Phi Delta Kappan, states: "I now think it is important in curriculum development to examine the concept of the learner as an active purposeful human being." Ross Mooney (7: pp. 172-179) described the curriculum builder as a person who seeks to find a "way of life" for himself to enable him to help educate his fellow man.

Dwayne Huebner (4: p. 31) was specific and direct to the point in his statement that "Man is a transcendent being, . . . he has the capacity to transcend what he is, to become something that he isn't. In religious language this is his nature for he is a creator . . . he participates in . . . the continued creation of the world . . ." Walter Guzzardi (3: p. 31) observed from the industrial environment that one's greatest satisfaction comes from success in making acceptable changes in one's institution. He identified the process of change-making as "creating" and creating as the "central aim of life." Douglas McGregor's

(6) "Theory Y" includes the basic assumption that creativity, imagination, and ingenuity are widely distributed among the population and the potential of the average human being is only partially utilized.

The Orchestrated Systems theory rests upon the creatorship of the human being and seeks better balance and consistency in our educational strategies for the creatorship function in relation to the inheritance functions. Orchestrated Systems theory has its counterpart on the industrial scene in a movement identified by Robert N. Ford (1: pp. 24-25) as the Third Revolution in Work. The movement seems to be reaching a magnitude worthy of the title; The Third Industrial Revolution. Rather suddenly there is the realization that the technological and the economic requirements, defined by scientific methods, have the primary priority and human needs have by default the secondary priority. We have taken for granted that the human being could be trained and motivated by "carrot-and-stick" formulas to fulfill the technical requirements and our educational system has solidly reinforced that strategy.

The secondary status of man is a difficult assessment because our society seems so successful when measured in terms of technological achievements and in terms of its high per-capita output of goods and services. The unsurpassed technological success provided solid assurance that our system of education and training was developing toward optimization. These are powerful lines of thought and they are mutually reinforcing to our faith in the scientific method for achieving optimization. However, a tremendous force contrary to this line of progress has surfaced like the tip of an iceberg that bears little evidence of the tremendous hulk underneath. The turmoil and dissatisfactions which have surfaced from our societal institutions have been difficult to understand but a clear message is emerging. There is a growing commitment to meaningfulness, to education relevant to that meaningfulness, and to human fulfillment for all. There is strong opposition to hold technical and economic commitments as first priority over human needs. The force may be defined as a humanizing movement and our industries are taking the leadership and are the major proponents for humanizing the work environments. Educators must not ignore this important movement. The Orchestrated Systems Approach pur-

sues this humanizing frontier and the implication for high school industrial arts is evident on this basic issue. It is appropriate and timely that Industrial Arts join in the humanizing movement.

The discipline developing on this frontier might be appropriately labeled "Ergonology" or "Ergonomics". Ergonomics was developed from the Greek word ergon meaning work, and was reportedly defined by the 1961 Geneva International Labor Review as "the Scientific approach to making work human." "Ergonology" is a new term that might easily gain a halo of respectability.

The issue is placed in sharp focus for education and industry by the summary analysis in Figure 1.

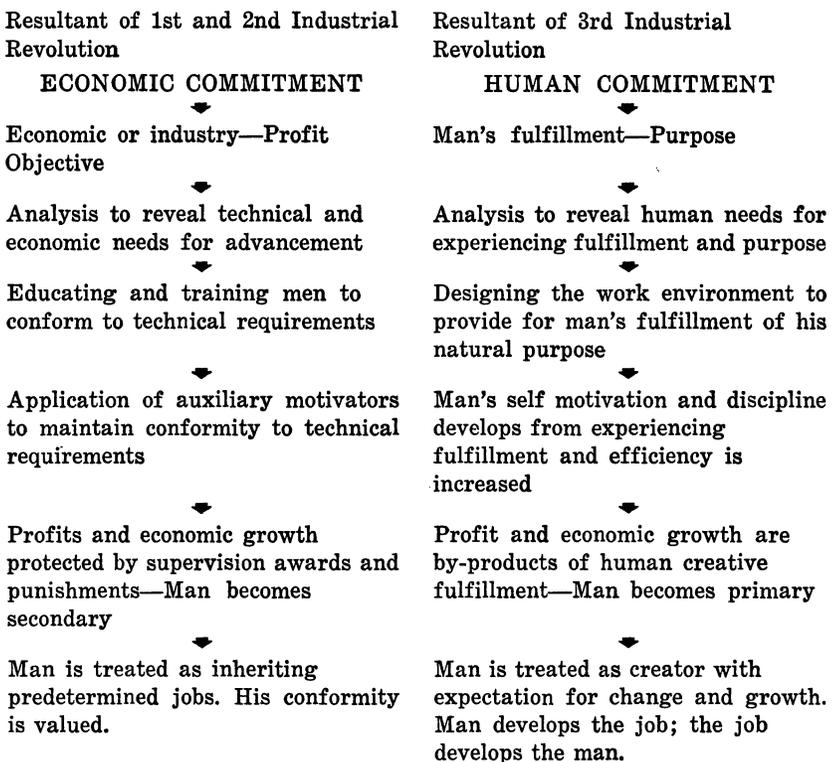


Figure 1. Alternatives for Primary Focus by Industry and Education.

Primary focus upon the economic priority has seldom been challenged by technical or industrial arts educators and the situation may demand a new discipline. It is timely that this issue is given adequate debate and experimentation. Its resolution in

favor of the humanizing alternative would have considerable influence upon instructional strategies and upon the design of instructional materials. The forces of the scientific method are being focused upon the human being as the primary priority and documentation of results are appearing in journal publications. Robert N. Ford's (1: pp. 24-25) article on the "Third Revolution in Work" was previously cited. Marco Gilliam (2: pp. 1-9) reporting in *Bell Telephone Magazine* described Bell's "Work Itself" program and gave enthusiastic support to the primary focus upon the human needs. Case study summaries from several corporations were reported by Harold M. F. Rush (8) in the Conference Board publication. Stimulation for early experimentation in industry came from the theoretical work of Douglas McGregor's *The Human Side of Enterprise* and from Frederick Herzberg's *Work and the Nature of Man*.

### FOCUS UPON THE ECOLOGICAL CONCEPT OF MAN

The human being does not function as a separate entity; he is always "geared" into his various environmental systems as a functionary or as a creative change agent for the total ecological pattern. Ecology is defined as "the mutual relationships between organisms and their environments" and this concept, applied to the human being, stimulates exciting new views and provides added parameters for thought in regard to the nature of environments which communicate fulfillment for working man or for creative man. The concept may be further examined by use of the following analogy: The automobile is worthless as a separate entity but takes on considerable value when it becomes geared onto a roadway through its wheels; and then only when the roadway connects with important places to be. Stated another way, the automobile derives value as it becomes a functioning sub-system of the larger total system. The system might be described as a "man-auto-roadway-community-communication-and-transportation system." Likewise, the human being is also a component of a larger system, or of an infinite number of systems and he cannot be viewed nor adequately understood if he is treated as a separate entity.

The Orchestrated Systems Approach treats individuals as components of systems and furthermore as creative change agents which stimulate dynamic growth and development of the sys-

tems. Growth and development of the individual and the environment become mutually affective relationships in which motivation and fulfillment are rewards inherent to involvement.

Primary focus upon the human being in his ecological patterns provides a unique point-of-departure for the identification of other issues for debate and for potential improvement of Industrial Arts.

### **FOCUS UPON THE ECOLOGICAL PATTERNS OF MAN'S WORKPLACE AND THE EDUCATIONAL COUNTERPART**

Man's enterprising efforts to supply his needs and wants have carried him far beyond fulfillment of needs. Seemingly, he institutionalized the systems of producing in order to gain cumulative advantages. His educational counterpart developed in parallel through early stages of change but failed to maintain the transition to match the contemporary practices. The evolutionary process of parallel developments of production systems and the counterpart educational analogue systems were illustrated in Yoho's mimeographed paper "The Orchestrated Systems Approach to Industrial Education" (11) and a copy of the illustration follows as Figure 2.

The titled classifications of our institutionalized production and educational systems briefly describe the continually changing ecological patterns of man's workplace. Many implications are obvious from Figure 2. The educational counterparts of our production systems are lagging far behind as accurate analogues of the institutionalized production systems. The educational system must include contemporary workplace environments even with all the dehumanizing faults and problems and man must direct his scientific methods and creative talents toward transforming the workplace into a more humanizing environment. Man has tremendous variability of creative talent and the workplace must change and develop through release of that creative talent. The school environment has developed as an artificial system quite irrelevant to contemporary work environments. The "school system" focus upon present instructional strategies sets conditions for predetermined technical requirements to which students must conform if they wish to be rewarded with passing grades (carrot-and-stick formula). Students are generally held

in a state of preparation rather than in a state of creative significant living in the present. Teachers in the school's artificial systems are assumed to have already inherited the accumulation of knowledge and skills which they must transmit to the inheriting youth. This is a sterile concept which stifles both teachers and youth from creative productivity in a dynamic, growing, changing work environment. If we expect significant living in the present, the school's ecological patterns should be analogous to societal patterns and the environmental systems must belong to the individuals who inhabit them. Individuals must experience the success and failure as they creatively enterprise for growth and development.

<i>Institutionalized System</i>	<i>Educational Counterpart</i>
I. The Hunter Family Enterprise	Father Taught Son Mother Taught Daughter
II. Agricultural Family Enterprise	Same
III. Craft Enterprise	Apprenticeship
IV. Factory Enterprise	Factory School (Vestibule Schools)
V. Corporate Manufacture and Service Business Enterprise	Service Apprenticeship Trade Schools
VI. Corporate Complexes and Service Industries	(Not developed)*
VII. Automated Plants Component Exchange Service	(Not developed)*
VIII. Cybernated Plants Creative (Knowledge based) Corporation Component Exchange Services	(Not developed)*

**Figure 2.**

**Evolutionary Development of Goods and Services Production Systems in Relation to Educational Counterparts.**

\*Counterparts for these developments have not evolved to the point of being clearly evident. The enterprise system as an environment for individual growth should be considered for the educational counterpart.

Content prepackaged for student verification is widely inconsistent with human creatorship. Instructional materials consistent in strategy with human creatorship are difficult to design. Dwayne Huebner's (4: p. 31) description of the curriculum responsibility is helpful in this respect. He identified

the responsibility of the curriculum person as a designer and critic of "specialized environments which embody the dialectical relationships valued in a given society . . . These environments must encourage the moment-of-vision, when the past and the future are the horizons of the individual's present so that his own potentiality for being is grasped." A schematic illustration of this concept was also included in "The Orchestrated Systems Approach to Industrial Education" cited earlier and it is included here as Figure 3.

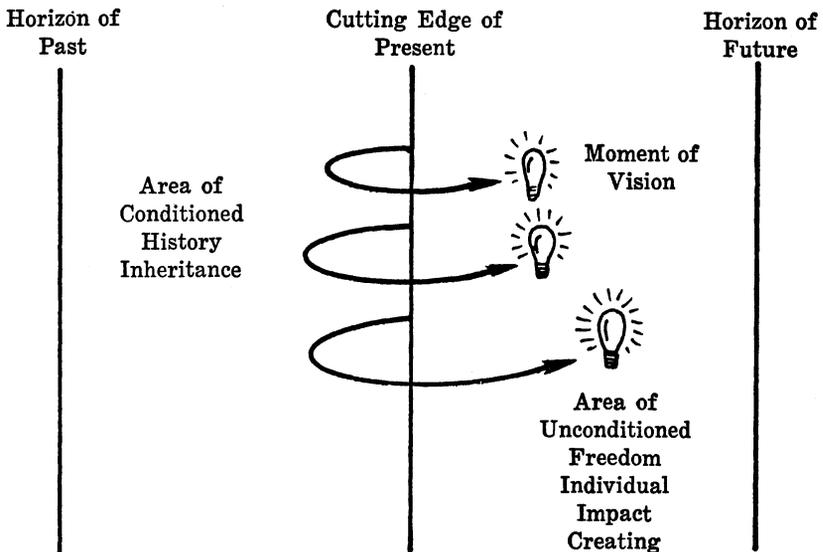


Figure 3.

Huebner's concept and the schematic illustrate the need for better balance for curriculum oriented toward the horizon of the future where creativity can be experienced. Most of our instructional strategies and instructional materials point toward the horizon of the past and are designed to provoke conformity and verification. The real, live, dynamic enterprise can provide the balance between the past and the future and systems concepts and techniques may provide the breakthrough for instructional materials. To achieve the breakthrough, the educator should develop proficiency with three types of system models including the Strategy Systems Model, The Tactical Model, and the Input-Output Evaluation model.

## FOCUS UPON SYSTEMS MODELS

The Strategy System Models present alternatives, the high-way road map is such a model. To achieve an objective a tactical plan and model is needed. Tactical planning is creative, expresses action, and generally spans from the past across the present into the future to identify an unattained goal. Strategy models are useful for guidance in the design of tactical models by stimulating the evaluation of alternatives and by promoting critical thinking and decision making.

Goal achievement from tactical plans should be followed by evaluation of output achievements in terms of input investments. For maximum fulfillment the individual must find areas of outlet for his own unique creative talent. This concept suggests a quadrant pattern based upon Huebner's horizons of the future and the past. The concept is illustrated in Figure 4.

An assessment of educational practices in relation to the quadrant learning pattern of Figure 4 illustrates the emphasis given to the past. Most educational efforts end with  $Q_1$  and  $Q_2$  experiences. Furthermore, most instructional materials are designed for the same two quadrant strategies. Instructional strategies and instructional materials designed for the future must provide emphasis towards learning quadrants  $Q_3$  and  $Q_4$ .

## FOCUS UPON INSTRUCTIONAL STRATEGY

The theory of teaching and learning which undergirds the Orchestrated Systems Approach is based upon development of individual self motivation and self discipline for investigation, discovery of new knowledge, and practice under anticipation for development of new and useful skills. The process provides the satisfying experience of creatorship fulfillment. The theory involves a plan for gaining adequate experience samples from orchestrated systems as a basis for seeking a match of interests and talents before moving toward, or polarizing around skill proficiencies. Individual differences are truly recognized and in fact, differences are required over a full range from the unknown beginner to the highly skilled and knowledgeable craftsman or technician. Also involved in the theory is the creation of concepts of the whole system and the demands of the whole upon its parts or sub-systems.

**Hypothesis:**

The human being is inheritor and creator. For maximum fulfillment, the individual must find areas of outlet for his own creative talent. The quadrant pattern should facilitate his ability to attain greater fulfillment, but not all students will achieve  $Q_4$  on all learning areas.

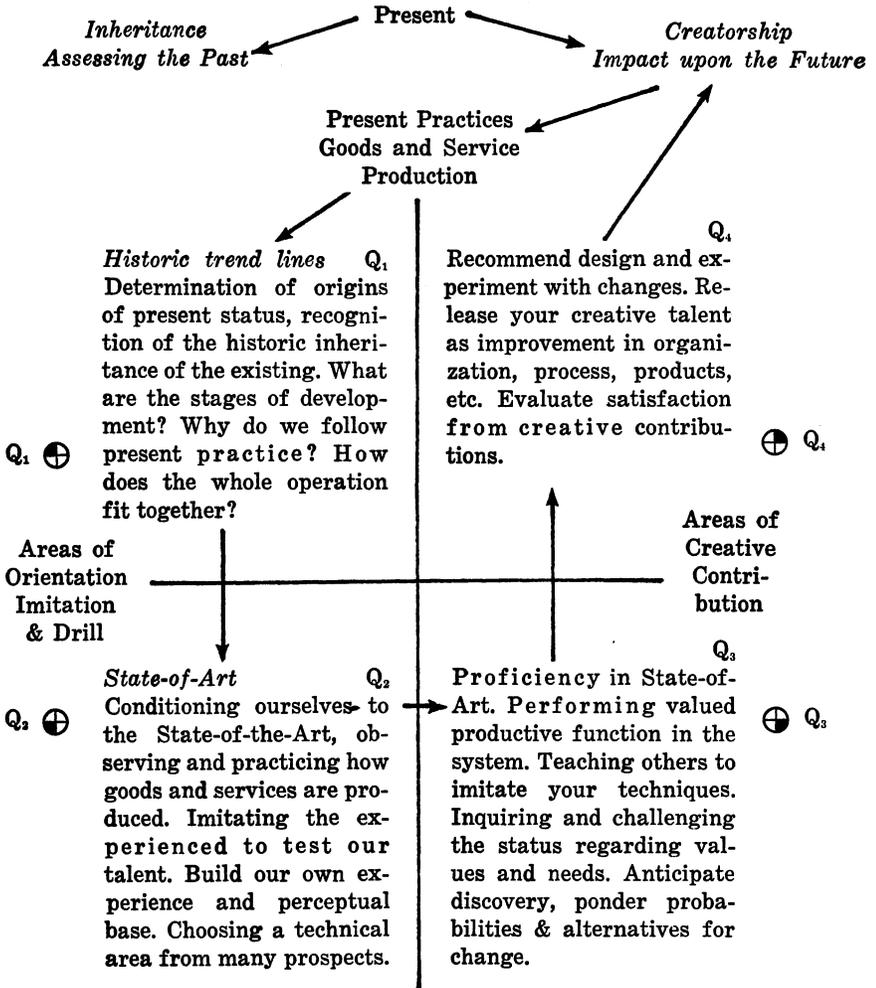


Figure 4. The Quadrant Learning Pattern.

The theory also includes the concepts of seeking improvements and changes, and in fact, expanding the technology by the same processes used by industry for its own advancement. The functions of research and development should bring the educational system to the "cutting edge" of change and the educational system, therefore, should be expected to contribute to the changing technology under conditions in which the human concerns are held primary. This seems to be our only hope for closing the broad gap between modern industry and education. Starting upon a similar system for development and change is not too demanding of education.

The major strategy for learning experiences involves the creation of an environment which includes the "game-in-play" activities. If the purpose is an understanding of how our society produces its goods, the whole manufacturing perceptual experience should be provided; if tool making is the purpose for certain individuals, the tool room functioning in support of the manufacturing operation should be perceptually experienced; if quality control is the purpose for certain individuals, the quality control functions and physical facilities should be perceptually experienced. All technical support areas for the manufacture of products should be available for individual students to gain knowledge and skill development just as the "bull pen" and practice areas provide for ball players to gain practice and skill in anticipation of performing in the "game".

The systems approach with its support areas for skill and technical knowledge development provides for good balance in skill and technical development. An over-supply of skilled or technical personnel is readily evident and the rapidly outdated survey-of-needs data is rendered less important.

The beginner should gain concepts of the whole industry system through direct perceptual experiences with the "orchestrated whole." He should have opportunity to try out various attractive responsibilities under apprenticeship-learning relationships. When motivated by interest from newly discovered talents, he should begin to polarize around specific proficiencies. His learning and development should originate with the "whole" of the system, then move to give attention to the "parts" or specifics. The individual's experience and learning will then be held

in proper context and he will seek new knowledge and skill development in anticipation of performing in the "game."

The "industrial-game-in-play" is conceived as an industrial enterprise environment which employs the same competitive and investigative techniques as the private enterprise industry. The educational industrial enterprise must belong to the individuals who staff it and the staff must be able to succeed or fail as changes are made through investigative processes which move the enterprise through cumulative effort toward more humanizing work environments.

### FOCUS UPON FACILITIES

Predetermined packaged instructional programs accommodate precision planning of facilities. Planning for dynamic, growing, changing enterprise is less precise. Openness and flexibility for changing activities have been the key descriptive terms but they mean different things to different individuals.

The facility should accommodate enough of the total dynamic enterprise to communicate the "game effect" or the synergism of the system. School learning systems should be good analogues of the societal production and service systems. They may be simplified but they must be real. The problem as described by Huebner (4: p. 31) assigned responsibility to the curriculum person "to design and criticize specialized environments which embody the dialectical relationships valued in a given society." The environment must motivate and teach and must be open enough that much general learning and understanding takes place while an individual pursues his own speciality to considerable depths of understandings and skills.

The facility problem has two major concerns including design of new facilities and conversion of existing facilities. Svendsen and Trippiedi (9) prepared guidelines and case descriptions to assist teachers with conversion of programs and existing facilities. Stanton Leggett and Associates, (5) Educational Consultants, have done considerable work in drawing up educational specifications for enterprise systems of instruction in all subject areas of the curriculum.

Unvalidated suggestions include the development of production systems schematics or models of "starter" systems fol-

lowed by abstraction of the basic parameters. An ideal facility for approximately 100 students would include about 8,000 to 10,000 square feet of open floor space with additional classrooms and conference rooms to accommodate variable size groups ranging from a small group to the total 100 students. The open space should accommodate heavy equipment and should be serviced over the entire area with electrical, air, gas, and water quick-connectors. A storage facility of approximately 1500 square feet is important for systems equipment change-over and for supplies and maintenance.

Follow-up studies which will produce data on space needs for enterprise system operations are needed, in the meantime data should be sought from the existing experimental programs and from certain small industrial plants.

### SUMMARY

The Orchestrated Systems theory holds primary focus upon the nature of the human being and advocates application of the scientific method to this primary target in order to improve the work environment to better accommodate the human being as he seeks fulfillment through work. The program approach is therefore categorized as humanizing in purpose and is identified with a counterpart movement on the industrial scene which is becoming known as the Third Industrial Revolution.

Educators who subscribe to the basic humanizing concepts of the Third Industrial Revolution will have need for instructional strategies and instructional materials which support those concepts. Behavioral objectives must be redirected from strategies which assign first priority to economic and technical requirements toward strategies which assign first priority to human needs for fulfillment through work. If changeover is pursued, it will be a difficult and hazardous frontier. Issues involving human control for the production of profit can be explosive. It is appropriate and timely that high school industrial arts undertake experimental work toward humanizing the work environment for man's fulfillment through work.

## BIBLIOGRAPHY

1. Ford, Robert N., "The Third Revolution in Work," *Bell Telephone Magazine*, March-April, 1971, pp. 24-25.
2. Gilliam, Marco, "Work Itself," *Bell Telephone Magazine*, Jan/Feb 1971, pp. 1-9.
3. Fabun, Don, Editor "The Corporation as a Creative Environment," *Kaiser Aluminum News*, V. 25, No. 2, p. 31 (citing Walter Guzzardi, Jr.) 1967.
4. Huebner, Dwayne, "Curriculum as Concern for Man's Temporality," *Theory Into Practice: TIP*, V 6, No. 4, p. 31 (citing Walter Guzzardi, Jr.) 1967.
5. Leggett, Stanton and Associates, *Enterprise for Education*. Educational Specifications for Cultural Educational Cluster #14, 1969, Educational Consultants, 910 North Shore Drive, Chicago, Illinois.
6. McGregor, Douglas, *The Human Side of Enterprise*, New York: McGraw-Hill 1960.
7. Mooney, Ross L., "Perspective on Ourselves," *Theory into Practice: TIP*, V 6, No. 4; pp. 172-179, Ohio State University, October, 1967.
8. Rush, Harold M.F., "Job Design for Motivation," *Experiments in Job Enlargement and Job Enrichment*, The Conference Board, Inc., 845 Third Avenue, N.Y. 1971. 83 pp.
9. Svendsen, E.A., and Trippiedi, L.R., "Guidelines for Organizing and Teaching an Educational-Industrial Enterprise in Secondary Schools," School of Technology, Indiana State University, Mimeo. Rev. 1972, 30 pp.
10. Tyler, Ralph W., "New Dimensions in Curriculum Development" *Phi Delta Kappan*, V 48, No. 1; pp. 25-28, September 1966.
11. Yoho, L.W., "The Orchestrated System Approach to Industrial Education," School of Technology, Indiana State University, Mimeo, Rev. 1971, 69 pp.

SECTION V

**Senior High School  
Industrial Arts Programs:  
Meeting Students' Needs**

# Meeting the Needs of the Gifted Student: Senior High School Industrial Arts Programs

*Ernest G. Berger*  
*Associate Professor*  
*The Florida State University*

*If a man exceeds the pace of his companions—perhaps he marches to the beat of a different drummer . . . . Anon.*

Which comes first—the gifted student or an industrial arts program designed to challenge the gifted? It would appear from observing programs across the country that gifted students do not elect industrial arts programs and that if they were to do so, there are really no cognitive programs that would attract and challenge them. Yet, such students do exist in our public school system and they are attracted by programs other than industrial arts. What then is the problem? Has industrial arts failed to design programs for the gifted or is it that industrial arts has been content to attract the below average students with below average programs? Have you ever wondered why you always end up with the bottom of the intellectual spectrum from your school population?

Perhaps part of the problem lies in the fact that due to the overwhelming needs of the disadvantaged, the education

decision makers have let the gifted student shift for himself in most school situations. Regardless of the discipline, no school subject area has ever really designed a program specifically geared to intellectually challenge such students. In fact, in most of our high schools, these highly creative and gifted students are often regarded as behavior problems. They are always wanting to do something different and often do more advanced work than the teacher can comprehend. When the unimaginative teacher attempts to keep them in the curriculum straightjacket, they rebel and soon become discipline problems. This is because the American school system insists that all students, dull, average or gifted alike, must learn solely by authority and not by making intellectual discoveries on their own.

In a very few cases, gifted students have been channeled to honors classes and the assigned teacher has been shrewd enough not to interfere with their headlong thrust at learning. When gifted students are brought together with other students of the same capabilities, remarkable changes take place and they are no longer considered the misfits. When taught in ways compatible with their true abilities and interests, their achievements begin to soar and the school discipline problems fade away completely.

The other part of the problem seems to lie in the fact that nothing much has ever been done to try to attract the gifted (or even the "better student") into industrial arts by offering cognitive programs that would really challenge them. Yet, industrial arts is really in the best position of all the subject areas to accomplish just that.

Unfortunately, public education still remains one of the last great strongholds of the manual trades. One of the barriers to any change (the transition from manual arts through industrial arts and into technology) is that new curriculum ideas and new teaching methods demand new insights on the part of the practicing teacher and the educational decision makers alike. Some teachers are unwilling to adapt to new course ideas, and others lack an understanding of the new subject matter and the best approach that the new materials require. The decision makers will not support something that they know nothing about.

### PHILOSOPHICAL RATIONALE

The consequences of technological change we are experiencing today have left our education policy makers and practicing teachers seriously behind the actual course of events. By the time the education profession is ready to react, all of the suggested educational changes have become obsolete or completely irrelevant. In addition, at the working level, the teacher experiences his own "built-in" program lag. Result? The most important members of the educational enterprise, the high school student, is ultimately exposed to a 1940 curriculum in a 1970 setting. Education continues to slip "light-years" behind the times.

There has always been the faulty assumption advanced by some of our industrial arts educators that the psychomotor skill training, such as is emphasized in most of the industrial arts programs today, makes it possible for our students to solve real life problems in the world of work. While a student may be able to pass a skill performance test in school; once out of the school, it is seldom that he can ever apply this type of specialized skill training to real life situations. On the other hand, he can expect to encounter endless situations requiring experience in problem solving and decision making regardless of his ultimate walk of life.

Industrial arts education in particular has been very lax in emphasizing "learning for change" through problem solving and decision making activities. In fact, industrial arts programs at the high school level emphasize more of the same old skill training and seem to be unable to teach a student to cope effectively with the dynamic changes that are taking place around him. It has been said that it was much easier to put a man on the moon than try to reform or update the public school system. Proponents of the present system would argue, "didn't we put a man on the moon with this same education system?" To which others would reply, "or was it in spite of the system?"

It is the view of this author that industrial arts has a very special responsibility to the American public to develop technically literate citizens who are capable of making intelligent decisions in the years ahead. To do so requires a different

type of industrial arts program and "mode of thought" to meet the real needs of the high school student who will soon become a part of the world of tomorrow. Such a program could even attract and challenge the gifted students as well.

What would an industrial arts program look like that was purposely designed to meet the needs of the gifted student? First, we need to understand the profile of the gifted student. According to the *Dictionary of Education*, the gifted student is defined as (1) a child whose mental age is considerably higher than his actual age compared with children in the general population; (2) a child whose performance is consistently remarkable in a worthwhile type of human endeavor. (Good)

### PSYCHOLOGICAL RATIONALE

Education psychologists tell us that the gifted student differs from other students in that he possesses the ability to deal with abstraction and generalization to a greater degree. He has accumulated a greater abundance of background knowledge upon which to generalize and to particularize from his generalizations. He seems to be able to apply his background knowledge to new things very effectively. He has a wider variety of interests and he tends to emerge as the leader or the mainspring of any group. He is very creative and wants to be challenged. He has a marked ability to solve problems, fabricate technical devices and to invent new things. He has high ideals and a worthy set of values and objectives. He is more sensitive and more of an independent worker than his contemporaries. The gifted student is full of the spirit of wonder and imagination and often displays high levels of attention, concentration and interest in things intellectual. He is always trying to find out how things work and becomes completely absorbed in the problem at hand.

He has an amazing capacity to organize and reorganize data and things. He can tolerate disorder for only a short period of time, but given the chance, will soon reorganize the data and his own activities in an effective manner.

The gifted boy or girl needs to function in an interdisciplinary environment which provides nurture for his abilities and diverse interests. In such an environment he is able to use

his mind and express his ideas, develop his communication skills, exercise his problem solving and decision making abilities, and other talents to a high degree.

The teacher of the gifted is always amazed as to how much general and specific information they possess and how deeply they think about things. They respond spontaneously to their environment and become completely absorbed and involved in it. Expectations are high as well as criticism of the educational "status quo" which prohibits expanding their learning activities. Serious problems can arise when the student exceeds the teacher's understanding of a problem and the teacher tries to drag him back to reality from some of his more absorbing activities. Because of the status quo, the gifted student often conceals himself within his peer group and many times he is difficult to detect.

### **PROGRAM DESCRIPTION**

Society's need for the gifted is overwhelming. Providing programs for the gifted high school student requires a very different set of operational parameters than for the average or below average student. It requires a teacher who understands the psyche of the gifted student and who is willing to provide the proper environment for productive learning to take place.

### **CHARACTERISTICS OF A PROGRAM FOR THE GIFTED**

A program for the gifted would encompass most of the following characteristics:

- (1) An inquiry-oriented laboratory.
- (2) A completely open-ended (not subject-centered) learning atmosphere.
- (3) Individual investigation and problem solving would be important.
- (4) Learner-directed research, development and reporting activities.
- (5) Creative, contemporary, problem-oriented experiences in decision making.
- (6) A self-challenging and motivating program.
- (7) Utilization of many "beyond the classroom" resources.
- (8) Inter- and intra-disciplinary in nature.

(9) A different "mode of thought" (i.e., there is no failure-only delayed success).

(10) Theoretical "constructs," "models" and "prototypes" developed.

(11) Understanding of the latest in technical and research developments across the related fields of math, science and technology.

(12) Low teacher-learner ratio (i.e., 1:10 is considered optimum).

(13) Teacher's role as stimulator and resource person.

(14) Language, equipment and tools of the researcher used.

(15) Seminar technique employed.

(16) An accelerated program of individualized in-depth technical studies.

Based on the above characteristics, the program model in Figure 1 was designed and developed to attract, challenge and meet the specific needs of the gifted student.

It will be noted that the above model envisions the teacher in a somewhat different role. With the gifted student, the teacher becomes the focal point for interaction and not the total authority as in the more traditional situation. As a resource person, he is the expert in knowing where to get the right answers. Many practicing teachers may not be able to live with this new role because they feel that they still must rule the classroom. For the teacher willing to take a risk, the new role can be an adventure in learning as he works along with the gifted high school students.

### INSTRUCTIONAL STRATEGIES

Our space program has suggested some exciting new learning concepts and instructional strategies which lend themselves well in the education of the gifted. Each of these strategies can be incorporated in the model. (See Figure 1.) They are, 1) Research & Development, 2) The Delphi Approach, and 3) Simulation and Gaming Techniques. Teachers of the gifted student might wish to consider some of these advanced concepts for their own use.

The Research and Development (R & D) approach represents a major departure from the traditional industrial arts

program to one that really involves the gifted student with complex principles, concepts, theories, relationships with decisions to be made and the outcome having to be lived with by the students. Both "software" and "hardware" products are the tangible outputs.

Research is defined as theoretical analysis, exploration and experimentation directed toward the increase of knowledge and thereby, the power to control phenomena. Research cannot stand alone and be of value until it is put to the test, applied or developed. Development is the extension of the findings and theories of a scientific or technical nature into practical application for experimental or demonstration models and devices. (Howard, p. 5) Development then is the direct result of research. In the R & D approach the gifted student works with the resource teacher in the *problem definition* stage. After

*Cognitive Level:* Scientist, Researchers, High-level Technicians and Middle Management Personnel

*Scope:* 10-12 Grade Level

*Conceptual Areas of Concern:*

1. Interaction Between Man and Man-Made Dynamic Systems
  - a. Human responses to complex systems
  - b. Pattern recognition
  - c. Man and machine interactions
  - d. Systems analysis
2. The Decision-Making Processes
  - a. Constraints
  - b. Criteria
  - c. Modeling Techniques
    - (1) Analysis and synthesis of models of complex systems
  - d. Optimization
  - e. Algorithms
  - f. Game strategy and simulation
  - g. Problem solving techniques
  - h. Ideation techniques
3. Introduction to Computers
  - a. The cybernetics of machines
  - b. Computer organization, functions and management.
4. Study of the Advancing Technologies
  - a. Space, inner and outer
  - b. Ultrasonics

- c. Advance propulsion systems
- d. Direct energy conversion and bio-power.
- e. Materials—fiber composites, synthetics, polymerization.
- f. Communications—holographic, fiber optics, micro-electronics, satellites.
- g. Management techniques
- h. Oceanics
- i. Systems—transportation, GSM, automation and control.
- j. Bionics, bio-engineering.
- k. Cryogenics
  - l. Instrumentation
- m. Research
- 5. The Patterns for Change
- 6. Related Laboratory Experiences
  - a. Problems involving optimization techniques
  - b. Queuing problems
  - c. Linear problems
  - d. Dynamic problems
  - e. Case studies
  - f. Other open-ended, student-designed experiments.

*Methodology:*

Student-elected, cross-discipline systems approach, involving technical problem solving, research and development activities, modeling and prototype development. Teacher acts as resource person.

*Basic of Truth:*

Applied Scientific Evidence and Knowledge

*Source of Content:*

Advanced Technology and Engineering  
Praxiology

*Facilities**Requirement:*

General Laboratory Situations

*Behavioral Outcomes:*

Using this model, the gifted student will acquire new intellectual skills in: decision-making, analyzing, studying, planning, designing, writing, inventing, engineering, creating, defining, delimiting, computing, experimenting, developing, interpreting, organizing, describing, scheduling, demonstrating, displaying, reporting, procuring, controlling, calculating, cooperating, measuring, operating, testing, and problem-solving.

*Program Evaluation**Technique:*

Pre and post measurement of behavioral outcomes as outlined above through use of the Technical Intelligence Quotient (TIQ) Testing Instrument.

**Figure 1. Model for a Program for the Gifted Student.**

problem selection, the student enters the *fact-finding* stage and gathers data and analyzes it as he progresses. Based on the data collected, he now enters the *idea-production* stage and tries to think up as many tentative solutions; he selects the best one from the group and verifies the validity of his selection through initial testing and other statistical methods. During the *evaluation* stage, he builds a prototype and tests it for operational effectiveness. (Schenck) Then he prepares and presents a *technical report* outlining his complete findings. Oftentimes, these efforts are so significant that manufacturers will support such research and development activities and publishers will publish the technical reports in their professional journals. It is the testing, applying and checking of the workable solutions and discarding that which does not prove fruitful that separates this instructional methodology from the others. Nowhere in the public school system are provisions better for the gifted student to combine his knowledge and research than in our existing industrial arts laboratories.

Delmar Olson suggests many challenging areas for a continuous pattern of research to keep abreast of the times. (Olson) Other examples of researchable ideas are outlined in Figure 2.

Noise Control Devices	New Composite Material
A Paper Battery	Low Cost, Disposable Car
Plastic Gears	Molecular Sieve for Underwater Habitation
A Submersible Airplane	Duplicate Strength/Size Ratio of Spider Webs
Bio-Chemical Fuel Cells	Develop a "Flat Motor"
Fiber-Optic Scope	Radio Controlled Andoid
Duplicate Adhesive	Nuclear Battery
Capability of Barnacles	

Figure 2. Researchable Ideas.

"The Delphi Technique is a method for the systematic solicitation and collation of expert opinion," says Olaf Helmer. (p. 11) "It is applicable whenever policies and plans have to be based on informed judgement, and this to some extent is virtually any decision-making situation," he continues.

The Delphi method appeals to the natural abilities of the gifted as outlined in the psychological rationale. It is a carefully designed student project that stresses sequential individual interrogations, usually by questionnaires, usually inter-

persed with previous information and opinion feedback, that has been carefully studied and analyzed. The mechanics of the system, according to Pfeiffer, involve the selection of a real life problem as well as a panel of experts in the field most closely related to the problem under study.

Once the candidates for the panel have been selected by the student-coordinator, they are invited by letter to participate in the project. The letter sets forth the real need for their technical opinion, describes the Delphi Technique, and then requests the candidates to indicate their willingness or ability to serve on the panel. The identity of the selected panelists must be kept secret during the course of the procedure. This action is necessary so as to avoid any undue influence of opinion by colleges in their normal role relationships. A panel of fifteen is considered optimum for this type activity.

A set of questions is developed relative to the problem at hand and sent out to the selected experts. The responses to the first questionnaire are then used by the student-coordinator to formulate a second questionnaire. The various reasons given for or against the various technical solutions or opinions expressed by the previous panelists are made known to the second group of experts so that they may respond more effectively. Generally, a consensus develops as the result of the convergence of opinions from the previous questionnaires. This process is continued through a third and fourth questionnaire at which time the student coordinator is in an excellent position to summarize and publish the findings in one of the professional journals dealing with the topic under study.

The teacher of the gifted student undertaking this activity should advise the student that key officials of the caliber selected for the panel are often busy and, therefore, long periods of time may elapse before an individual finds time to reply to the questions posed and to state his viewpoint thoroughly. Therefore, it is suggested that alternate activities such as researching the literature and/or interviewing local industrialists about the problem would help fill in during the waiting period.

This technique has been used extensively by the author and his students in seeking new and expert opinion in the solution of technical problems in space technology. An example of a

potential problem that would lend itself well to the Delphi Technique might be a re-examination of the objectives, motivation, organization and administrative of educational activities of the public school system with the view of discovering and incorporating new ideas, techniques and procedures from industry.

Simulation and Gaming Techniques are relatively new approaches in educational teaching although they have been used effectively by industry for over fifty years. By definition, a simulator is an operating device that is designed for research, learning or to replicate certain operational modes of action. It provides students with real life problems and gives the experience of decision-making on a miniature prototype of the more complicated problem. The World War II Link Trainer is an excellent example of an early simulator replicating actual flying conditions for the training of pilots. Today, NASA uses simulators extensively to train their astronauts for their lunar travels. This technique teaches students to think creatively and critically. The more gifted the student, the more he can profit from such simulations. This is because he is better able to conceptualize and relate what is going on in the simulator to the real world of activity.

Computer-based learning is another type of simulation and gaming technique that is often used by education, business, government and industry. Programming computers to simulate different learning activities would be an excellent experience for the gifted student. For example, a learning simulation could be programmed to simulate the role of a business executive as he progresses through a compressed 20-year time cycle, as he makes business decisions involving a fluctuating business market. Or it could be in the role of the scientist who might be involved in the development and management of a useful technical product for the world market. He might program the computer to simulate random technical problems that could hinder production and would require extensive decision-making on his part. This would allow the gifted student opportunity to learn and play future roles that may become a part of his life's work. Even the gifted can profit from simulated career education experiences such as might take place in the "think tanks" of our nation.

To achieve the ultimate in simulation dividends, the gifted student should design and fabricate his own simulator and validate it through extensive testing. While a student-designed simulator may not always turn out to be perfect, it does involve the student-designer in a process similar to the experimentation of scientists and engineers, which brings to bear a combination of research, imagination and inquiry experiences—all on an interdisciplinary plane. (Figure 4 is an example of this type of advanced work.)

There are many ideas that lend themselves to simulation activities. A few of them are listed in Figure 3.

Nuclear Reactor	Space Batteries
Skylab	Space Taxi
Launch and Flight Control Center	Space Truck
Space Stations	

Figure 3. Simulation Activities.

### PROGRAM EVALUATION

Evaluation of open-ended activities such as problem solving, decision-making, research and development, the Delphi Technique, etc., is rather difficult to accomplish with the ordinary tools of measurement available to the teacher. Therefore, it is suggested that subjective performance measurement based on close observation of the results attained by each student be utilized.

These are some of the ways industrial arts can keep pace with the dynamic changes that are taking place in our technically oriented society. While the evolution in education technology has scarcely been felt in the industrial arts laboratory, an inevitable change is actually creeping into our profession that will have a profound, long range effect on industrial arts education in the years to come.

The lag between technology and the instructional innovations that spin off from such activities, coupled with the human ability and tendency to deal with them constructively, still appears to be one of our major problems in industrial arts education. If our future programs would add the basic elements of technology and introduce new instructional techniques that

High School \_\_\_\_\_  
 Student Name RANDALL NEWTON Signature \_\_\_\_\_  
 Faculty Associate ERNEST G. BERGER Signature \_\_\_\_\_  
 Starting Time-Quarter \_\_\_\_\_ Date \_\_\_\_\_  
 Completion Time-Quarter \_\_\_\_\_ Date \_\_\_\_\_

In the space below write a brief description of your DIS project:

Title: Research, Develop, and Fabricate a Cooling Device for  
 Near-Cryogenic Temperatures

**Rationale for Selection of the Problem:**

To become acquainted with standard low-temperature engineering design research procedure and to apply that design procedure in the actual construction of a machine capable of attaining  $-130^{\circ}\text{F}$ .

The machine will be used to maintain viable biological cell samples at appropriate low temperatures over long periods of time. Further uses might include the preservation of fast crystallizing aluminum alloys at proper temperatures to prevent metal fatigue and the investigation of pseudo-metallic solutions of ammonia.

**Possible Solutions-Outcomes Expected:**

Four methods are currently available for generating near-cryogenic temperatures without using high pressures: (1) the Hilsch vortex tube, (2) the Stirling cycle, (3) the reversible expansion engine, and (4) the cascade system. Of these four, the cascade system seems to offer the best combination of practicality and thermodynamic efficiency.

**Procedure:**

The project will include:

- (a) Submission of an initial working drawing and step-by-step outline of fabricating operations to the faculty associate.
- (b) Consultations with faculty associate at one-week intervals to review assembly outline and assess progress.
- (c) Further consultations with local resource persons to clarify any technical problems that might arise.
- (d) Maximum use of off-the-shelf technology and materials.
- (e) Minimal use of critical shop machinery and personnel is anticipated. Construction involves only the oxyacetylene torch and power metals saw. No other machine tools will be required. Fabrication will be arranged so as not to interfere with regularly scheduled classes of the Industrial Arts Department.
- (f) Submission of a final technical report that will include engineering data on the machine, a description of the design process followed, and a summary of possible industrial and educational uses for such a machine.

**Figure 4.**

**Typical Directed Individual Study Contract for the Gifted Student.**

are on the scene today, then our teaching field might assume a central position in the educational profession—instead of remaining on the periphery in most school settings.

Let's hope that more of our practicing teachers and teacher educators become "risk-takers" and develop future-oriented programs that will meet the needs of our gifted students. Society's need for the gifted is indeed great.

The author gratefully acknowledges the contributions of the following persons: Carl A. York, Bensonville High School; Charles H. Story, East Tennessee State University; Rex A. Nelson, Georgia Southern College; Arnie Nielsen, Western Carolina University; Jerry B. Wright, Western Carolina University; Allen Bame, North Carolina State College.

### REFERENCES

- Good, Carter V., *Dictionary of Education*. New York: McGraw-Hill Book Co., 1959.
- Helmer, Olaf, *Analysis of the Future: The Delphi Method*. Santa Monica: The Rand Corp., 1967.
- Howard, G.W., *Common Sense in Research and Development Management*. New York: Vantage Press, 1955.
- Olson, Delmar W., *Industrial Arts and Technology*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963.
- Pfeiffer, John, *New Look at Education System Analysis in Our Schools and Colleges*. New York: The Odyssey Press, 1968.
- Schenck, Hilber, *An Introduction to the Engineering Research Project*. New York: McGraw-Hill Book Co., 1969.

**An Experimental, Inter-  
disciplinary Career Program,  
Designed for the  
Non-Academic Students in the  
New York City High Schools**

*Gordon Lebowitz  
Director, Correlated Curriculum Program  
New York City*

What does a budding auto mechanic do when he attempts to install a car battery and the cables don't fit properly?

He can follow the advice of his fellow young mechanics, and in the best tradition of the do-it-yourselfer, he can hit the cable with a hammer, kick it or swear at it. If he were in the Correlated Curriculum Program, he would be advised by his industrial careers teacher to, "Look it up in the manual." But that wouldn't be all he would do that day. In his science class, he would have a specially prepared lesson on electricity with emphasis upon electrical impulses generated by a car battery. Or, the student might study parallel and series circuits related to the car's electrical system. In mathematics, the same day, the student mechanic would be solving problems based upon Ohm's Law or other problems on electrical circuitry. Then, when he went to English, he would read excerpts from the very sections of his car manual on batteries.

Another example of correlation will perhaps clarify the concepts underlying this experimental program. A student is making a drawing and planning board as a basic introductory project in his industrial careers class. In the shop, he will be learning the manipulative use of basic shop and woodworking tools. When he attends the mathematics class he will more readily understand the theory underlying angles and their measurement. The science teacher will have the class examine various kinds of wood under the microscope to better understand the properties of the wood with which they are working in the shop. The English teacher will have the students write an expository paragraph on the uses of the planning board and related instruments in industry. Finally the social studies teacher will engage the class in a discussion of the economic value of our wood resources, or perhaps needed conservation methods of our forest resources and forest products.

This, then, is correlation. The correlative approach presents the student with significant unification of subjects, all revolving around his career interest. When approached in this manner, correlation attempts to break down artificial barriers between subject disciplines that have been traditional in our high schools. Correlation between career training and education, and academic learning stands at the heart of this experimental program. Problems and difficulties in one subject are often cleared up through another subject area approach. No longer do we hear a student's frustrated wail, "Why should I learn algebra? What good will it do me if I want to be an auto mechanic?"

The answers are quite apparent to him when he uses algebraic concepts in the direct solution of shop problems.

Correlated lessons do not come about by accident. The teachers in the team meet each day for one class period to plan correlated lessons. In order to assist teachers who are new to the program, or those who are unimaginative, or do not have a broad educational background, a basic interrelated curriculum has been provided. There are suggested unit plans as well as detailed lesson plans for each aspect of the career program. In addition, student workbooks and textbooks have been written by skilled teams of curriculum writers. While

these extensive materials are available to the teaching teams, they have been given wide latitude to experiment on their own, especially if they can come up with better correlated lessons than those which have been suggested.

Team planning periods serve other useful purposes. Some of the time is devoted to personal guidance, or to remediation or even tutoring. The program in each school is served by a guidance counselor for we believe that guidance is crucially important to the program. In effect and practice the members of the teaching team also serve as surrogate guidance counselors. For the first time in a student's school career, he has five people who know all about him, are interested in him and are there to help him. The backup guidance of the team was an unlooked-for major plus of the program.

During the first three semesters of high school, that is, during the ninth and first half of the tenth years, the student explores possible careers in health, business and industry. At the end of this extensive exploration and orientation period in which field trips are an important part of the process, the student makes a choice of career. Choice is thus delayed until the student is older, has experienced various options and has the advice of his team and of his counselor. He then follows his career for the next three semesters bringing him to his twelfth or senior year. During his final year in school the student engages in paid work-study experience. He earns while he learns. Placement is effected by the Bureau of Cooperative Education which is organized for that function. This bureau also supervises the student on the job.

If a student's choice is industrial careers, he may have a further choice of courses in building and maintenance, electricity and electronics, transportation (auto mechanics) and drafting. These careers have been selected because of the employment opportunities available in the New York City area. The courses are also limited by the shop facilities resident in the experimental schools.

Students, having made a choice, are not bound by the choice. They are not locked into the program. We conceive of the correlated program as an escalator on which the student can move or get off according to his needs and progress. Students who are "late bloomers" have been allowed to try out varying com-

binations of academic and career courses. Others are allowed to take some academic courses to improve their occupational skills or even to help prepare them for higher technological education. One success story tells of a young student who was finally moved into a straight college-bound program after two years in the correlated program. She did so well in the academic program that she was finally elected president of the school's honorary society as well as president of the student organization. When she originally came into the program she had been retarded by three years in her reading and consequent disability in mathematics. Three years reading retardation is an important criterion for acceptance into the program, along with possible interest in an occupational career.

The misnamed, "general student," or non-academic, non-college-bound student often develops a rebellious or apathetic attitude about his high school education. He sees no direction or purpose to his studies. Failing to qualify for entrance in the college preparatory program, such a student often drifts aimlessly and more often is a prime candidate for "high school dropout." The program was therefore designed to provide a viable, motivated career education for this large group of young students for whom nothing was offered in past year.

The main features of the program are:

- Exploratory and orientation courses in business, health and industry in the ninth and first half of the tenth years.
- Specialization in one broad occupational area in Grades 11 and 12.
- Emphasis upon basic manipulative skills in all subject areas.
- Special counseling and placement service. One full-time guidance counselor is assigned to each program in a school.
- New curriculum materials designed to provide correlation between subject areas.
- A renewed emphasis upon improvement in reading and mathematics.
- Provision of teacher time to provide team planning, and to allow for remediation and team guidance.
- Special training workshops for teachers in the program.

- Smaller classes to individualize instruction.
- Emphasis upon broad clusters of salable skills with on-the-job training and experience.
- A student-centered program and approach.

The program works because of many factors, some of which are still unexplained. The student is encouraged to remain in school partly because he is earning money while going to school. He is encouraged to take his job problems back to school to discuss them with his teachers and counselor. The program works because it has a built-in series of motivational factors. He sees a reason for going to school. He is successful because he is interested, and interest begets more success. He has a career goal. He has teachers who can help him and are interested in him as a person, not merely a faceless body sitting in a school seat.

If we go further afield to explain why the program works, we may explain learning in the program according to Gestalt psychology. Correlated lessons provide a pattern and a configuration of learning patterns that seeks to unify knowledge, to clinch basic concepts through multiple associations. Just as in the theory of multiple-sense appeal underlying the extensive use of audio-visual aids, the greater input of neural stimuli resulting from correlated lessons will create more neural pathways along with associative pathways to learning centers of the brain. The student sees relationships between subjects because he is exposed to interconnected impulses underlying these relationships. His learning is enhanced through manipulative skills. Thus there is afforded him a variety of associated impulses over a concentrated brain area thus consolidating collateral and association neural connections. In our educational language we often call this process reinforcement of learning and the development of concepts. In our view, the correlated methodology affords both reinforcement of learning as well as provide a broader base upon which concepts can be developed.

The program has been in field operation for the past five years in eleven representative high schools scattered throughout the city, with about two thousand pupils. How has it fared?

Several evaluative studies have been done by the director and his staff as well as by independent outside agencies. The baby is alive and kicking!

In 1970 the overall dropout rate for all grades of the program was 3.3% compared with the general dropout rate for general course students in the city high schools of about 40%. In 1971 the program's dropout rate was smaller, 3.1%.

Do students in the program attend school? The answer is a resounding, "Yes." In 1970 the attendance rate was 91.1% attending school each day. A year later, in 1971, the rate was still high, 89.5%. The attendance rate of all other students in the pilot schools was 69.4%.

How have our graduates done? The first graduating class was that of June 1970. A followup study of these graduates showed the following results:

Graduates Employed .....	78.1%
Graduates Working in the Same	
Career as in High School .....	63.1%
Attending College .....	31.2%
(Either full time or while working)	
Maturity and Responsibility	80% Improvement
(Rated by the Staff)	
Work Skills and Work Habits on the Job—"From Average to Very High" (Rated by Employers)	
Reading Improvement . . .	16.5 months over a 20 month period
"Was the Program Helpful?". . .	79.7% of the respondents,
"YES."	

An unpublished Master's Thesis by a teacher in the program, Mrs. Adele Greenberger, at Newark State College was recently completed. She did a similar followup study of the graduates of the program from one school. Her results were for the class of June 1971. The results surpass the results quoted above. She found that improved aspirational levels are reflected by the increased number attending college—39.2%. There were 78.1% then working. Of these, 64.7% were working at the same job they had held in high school in their work-study aspect of the program. These jobs were directly related to their school training represented by the figure of 91.7%. There were eight students working and attending college. There were 97.3% who agreed that the program had helped them to remain in school and to improve their career aspirations as well as to give them salable skills.

The results quoted parallel the results obtained from an interim study in 1968-1969 by the Psychological Corporation.

So, the program works! But, where do we go from here?

All new schools now being built, or on the planning boards, in New York City will contain Correlated Curriculum workshops, laboratories and special classrooms. There are many schools that have become convinced of the intrinsic appeal of the program for their students. They have applied for admission to the program so that we now have a "waiting list" of nine schools eager to provide this program. The program has been blueprinted for the high schools of the future by the report of a special task force in "Towards the 21st Century for the High Schools."

The clue to the success of any program for the non-academic student is a strong motivation for him, and interested, skilled, dedicated teachers. Only too often our high school youth is listening to a different drummer, albeit a "rock" drummer. Horace Mann's warning is still true today: "The teacher who is attempting to teach without inspiring the pupil with a desire to learn, is hammering on cold iron." The Correlated Curriculum Program, through re-motivation, through individualized guidance, through interdisciplinary teaching and through re-dedication of the student to the practical aspiration of a career has re-heated the iron of motivation.

# **Pittsburgh's Industrial Arts Programs are Performance Oriented and Designed to Meet Student's Needs**

*Jerry C. Olson  
Assistant Superintendent  
System-Wide Programs and Services  
Pittsburgh, Pennsylvania Public Schools*

Industrial Arts in the Pittsburgh Public Schools System is a component of The Occupational, Vocational and Technical Education Division. The Division, created in 1964, was charged with the responsibility of providing viable educational programs for 60% of the student body in senior high schools. Opportunities for all senior high school students to participate in OVT program offerings were provided by merging existing academic and OVT programs and facilities to develop 13 comprehensive high schools.

Movement toward comprehensive education enabled program planners in Pittsburgh to tap many human resources from community leaders, union leaders, management organizations, social agencies to parents and students. OVT was to be from inception people-oriented. Development work on motivation and motivational techniques, using the student himself as the basic source of the data, became an integral part of all

programming efforts. The individual became as important as a body of knowledge. A constant search for creative and unique ways of presenting the subject matter became a task pursued with energy and vigor by all concerned. As guidelines to program development, the Occupational, Vocational and Technical Division focused on the following series:

### **DEVELOPMENT OBJECTIVES**

The OVT Division identifies curriculum patterns which are cross disciplinary and provide broad educational bases for student election of courses by developing an operational system outlining modules of knowledge that can be combined to develop individualized programs for students.

The OVT Division identifies and demonstrates internal and external communication systems by surveying the current operational procedures of the division as well as identifying those community and business models which assist in the development of programs.

The OVT Division defines and operationalizes the role of advisors for programs and related activities of the division by establishing a communication system with the industrial and social communities of Pittsburgh and involving representatives from the various groups in developmental phases of curriculum, facility planning, and related activities.

The OVT Division establishes and demonstrates selected pilot programs which are related to occupational education and innovations in the areas of curriculum and educational technology by defining the various patterns of programming which are necessary for students to meet the demands of both the social and industrial community.

### **IMPLEMENTATION OBJECTIVES**

The OVT Division operates programs which are interdisciplinary in nature and encompass the areas of business education, distributive education, home economics, industrial arts, agriculture, health education, and trade and industrial education. This is achieved by writing courses of study and maintaining systems of programs which are related to input provided by advisory committees, students, teachers, and administrative-supervisory staff.

The OVT Division establishes a series of program options by (1) identifying community and the job market needs; (2) outlining and maintaining current information regarding changes in knowledge cores; (3) diagnosing current social problems which influence occupational education; and (4) establishing and maintaining a system which reflects the individuality of students and their unique potentials.

The OVT Division defines and demonstrates programs which are exploratory in nature and which provide a base for the selection of skill-centered education by providing students at the 6th through 10th grade levels with a series of exposures to cores of knowledge representative of the major areas involved in the OVT Division.

The OVT Division institutes programs which require highly technical, advanced or specialized training beyond the secondary level by identifying industrial opportunities for specialized training.

The OVT Division tests and operates a series of cooperative experiences for students enrolled in skill-centered programs in order to provide a supervised work activity which is educationally related by establishing and maintaining a supervisory and counseling staff which surveys current market and industrial needs and places students in cooperative employment situations commensurate with their competencies.

The OVT Division identifies needs for occupationally related programs which can operate apart from the mainstream of education and provide youth with opportunities, other than basic day school programs, to explore the world of work and to engage in activities which offer remuneration for involvement in productive activity.

The OVT Division operates a continuous program of in-service education for teachers, administrative staff, and other interested members of the Pittsburgh Public Schools by identifying needs and interests of teachers and by outlining systems for establishing communications between teachers and administrative staff within the division.

### **MANAGEMENT OBJECTIVES**

The OVT Division demonstrates the use of resources which are related to the establishment of budgets for program imple-

mentation, the design of new educational programs, research, in educational technology and the labor market by identifying budgeting contacts within the Pittsburgh Public Schools and with leaders of special foundations and/or governmental agencies.

Education must be more than a composite of objectives set for a discipline or school division. The determination of the aims of schooling and the interrelationship of the contribution that a discipline can make in accomplishing goals is a high priority in Pittsburgh.

A system for determining direction cannot become a sacred cow; the people it serves must provide the momentum and direction. This includes students because we need their input to determine the rights of passage from adolescence to adulthood and from school to work. The Development Process stage is important to insure that the student will be instructed in programs that are built into the total overall plan that has both external and internal inputs. A result of implementing systematic planning and development is that purposes defined for the program will function by public consent and that the objectives will be consistent with society's goals.

In order that industrial arts continue to have creditability and to enhance its image it is important that the discipline's antenna be sensitive to the objectives set for a given set of students in a given community. Solutions will not come from carelessly scrambled roles for various disciplines. Instead, solutions must be integrated in current programs in a systematic manner.

### EVALUATION CRITERIA SETTING PROCESS

What industrial arts can and should become in any given school setting will depend greatly upon the direction and leadership that is provided in the system for reaching goals and assessing the effectiveness of the effort. As conceived in Pittsburgh, the OVT program requires continual evaluation and a closed-loop criteria setting process.

The operational needs assessment process is *key* in evaluation and criteria setting. (Figure 1 overviews a needs assessment system.) Input from the Business/Industry Task Force

and the Parent/Student Task Force is fed directly to the operational needs assessment process. This input alone is useless, of course, until other staff personnel components of the system become involved. The most direct involvement comes from Program Personnel (Teachers, Implementers) who can relate the "needs" to existing "program information". Program Management (Board and Administration) and Operational Management (Curriculum Program Planners and Principals) utilize the Needs Assessment to continually evaluate, adjust direction, and provide leadership and encouragement for the implementers (teachers). A centralized filtering process used to collect and store data provides both formative and summative information to policy makers upon request. The diversity and wide range of inputs from many sources helps insure continued progress toward pre-planned goals.

### INDUSTRIAL ARTS IN PITTSBURGH

Industrial arts in the senior high school is designed as the bridge between broad-based OVT exploratory experiences offered in the middle school grades 6, 7, 8 and instructional units provided in specific vocational programs during grades 11 and 12. In addition, students may pursue their industrial arts experience throughout the senior high school grades on an elective basis. Typically, students can enroll for 1 or 2 periods per day.

Industrial arts, much the same as skill-centered vocational education, is viewed as a performance-oriented undertaking because of the intent to realistically serve the needs of an inner-city student body. Ability to demonstrate both for himself and others specific viable skills, enables the student to provide evidence of a change in attitude, actions and life style. This rationale then becomes the basis for identifying industrial arts in the senior high school as performance oriented.

Figure 2 identifies components of a performance-oriented OVT education in industrial arts and compares it with similar components in trade-industrial-technical education.

The variable of time permeates the performance components of OVT Education. Compulsory attendance laws, the designation of the school day and a given school year, make

time an impelling ingredient in program planning. The vast majority of students are accommodated by wide range time sequences. Students are able to then dovetail industrial education experiences with other programs and, at the same time, accommodate their aspirations and abilities. Most students in grades 9 and 10 pursue industrial arts on a single period basis, some take a single period in more than one activity and others schedule 2 to 3 periods in industrial arts laboratory activities. During the past 7 years, over 50% of all 11th and 12th grade students in the Pittsburgh Public Schools have pursued a skill-centered program on a 2- to 3-period basis. Students who have made a definite commitment to a career goal generally are in one of 54 skill-centered vocational programs. Others may spend one or two periods in an industrial arts laboratory in grades 11 and 12 generally because (1) they have not made a definite career choice; (2) they are studying the more "holistic" concepts in a given clustered area; (3) they desire the flexibility to continue to explore rather than meet specified requirements (both time and content); or (4) the career goals they have established for themselves are on a longer range and include advanced education beyond high school. To meet the individual needs of students it is essential that many variations in scheduling be used to provide flexibility in the school day.

As generalized in Figure 2, the philosophy on which the many components of the program are based identify the intent and objectives set forth for the program operation. The program directions are often packaged in behavioral terms and comprise the "software" of the operation. The term "Industrial Education" encompasses industrial arts and skill-centered trade-industrial-technical education in the senior high school.

The montage in Figure 3 identifies four clustered groupings in the field—*construction, manufacturing, graphic communications, transportation*. The four clusters were chosen after a thorough analysis of the labor market revealed that there were entry-level employment opportunities for students who were able to demonstrate performance skills developed during the senior high school.

The rationale for the use of clusters in both the junior and senior high schools stems from the identification of the Major Occupational Groups encompassing 1318 definable career ob-

jectives and the designation of 943 spin-off career goals. Reviewed as to area, the following pattern totals occur:

Construction	203 Careers	180 Spin-off Careers
Transportation	567 Careers	448 Spin-off Careers
Graphic Communications	215 Careers	70 Spin-off Careers
Manufacturing	333 Careers	245 Spin-off Careers

Cluster knowledge and skill content has been identified by instructional units. Each instructional unit or specific objective is represented in a course guide by identifying (1) the developing core, (2) activity, and (3) evaluation. Content in the course of study presentation is identified by program. For example, salable skills are developed in programs offered on a 2- or 3-period basis daily in content packages for the following:

Construction	12 programs	(See montage in Fig. 3)
Transportation	11 programs	(See montage in Fig. 3)
Graphic Communications	9 programs	(See montage in Fig. 3)
Manufacturing	11 programs	(See montage in Fig. 3)

The instructional unit content from specific programs can be combined in modular learning units provided in industrial arts education for students pursuing performance goals for any number of reasons: (1) to develop skills related to advanced work they intend to pursue; (2) to pursue avocational interests; (3) to relate pure scientific principles to practical experiences; (4) to study the whole (holistic) aspect of an undertaking rather than specific details; and (5) to have an understanding of an operation rather than the desire to develop a high degree of skill through long hours of practice.

Any number of modular learning units can be combined from the program instructional units to form the content framework for industrial arts at the senior high school. Flexibility in combining the modular units is encouraged because it is felt that only by this means can the individual needs of students be met. Individualized instruction can also be fulfilled by grouping students with similar objectives and attempting to fulfill their objectives through a different individualized content grouping. This approach led to the content being grouped into the following modular learning units provided by industrial arts education in grades 9 through 12:

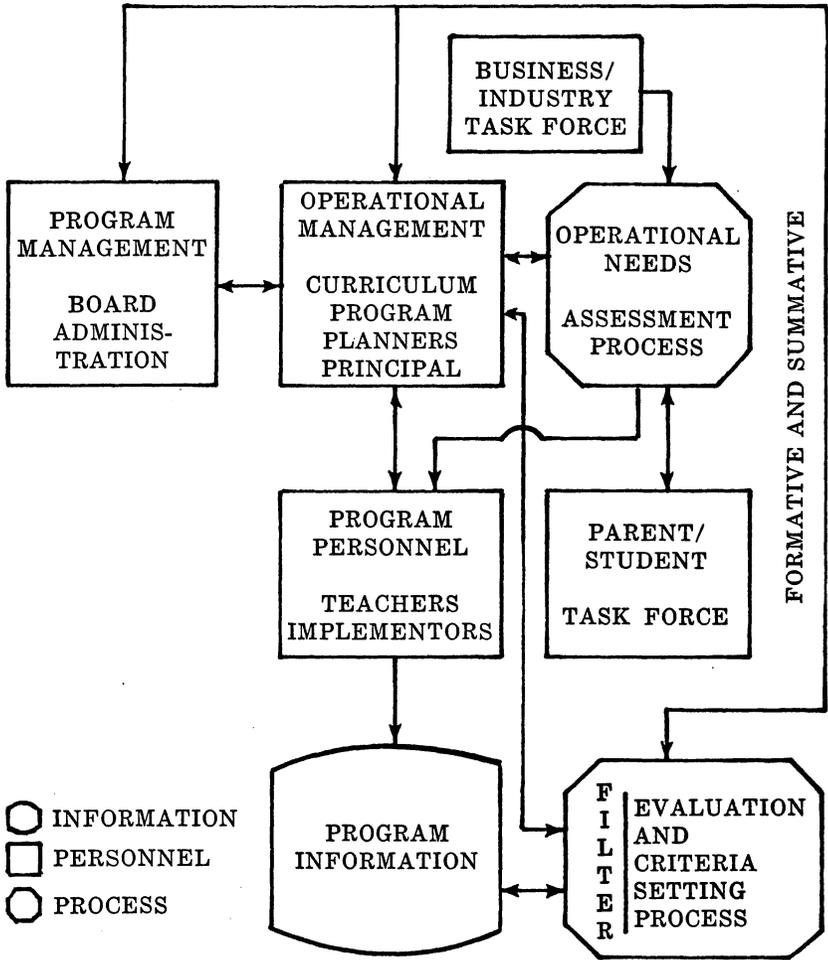


Figure 1. Evaluation and Criteria Setting Process.

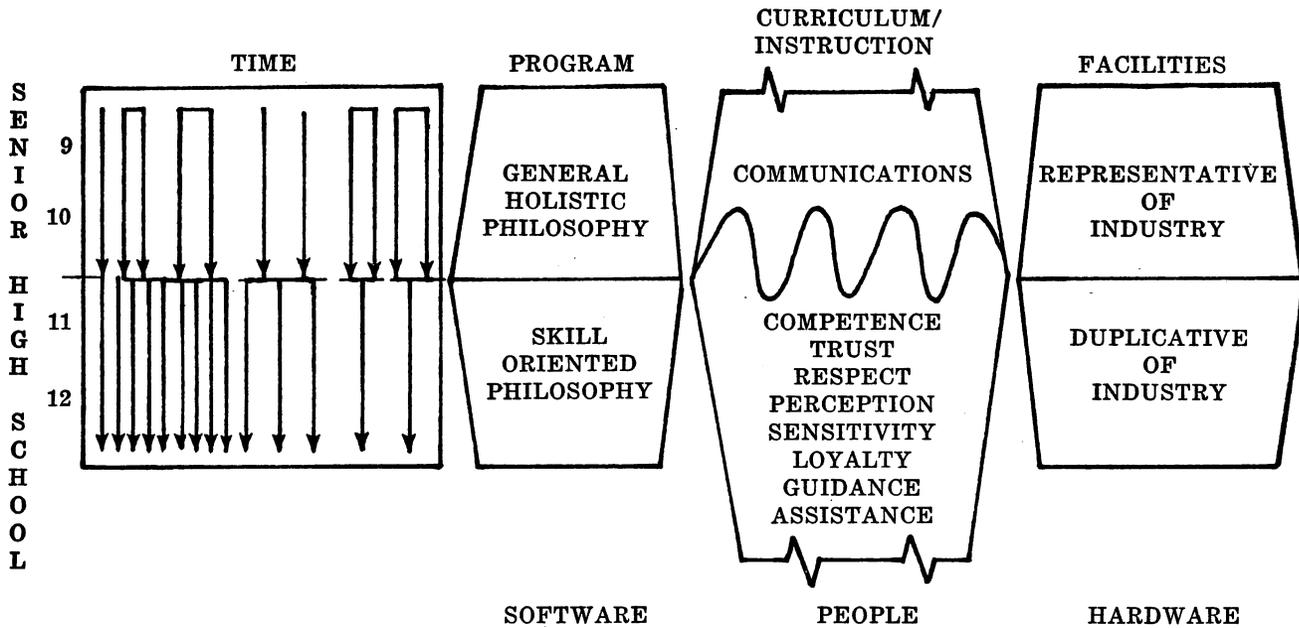
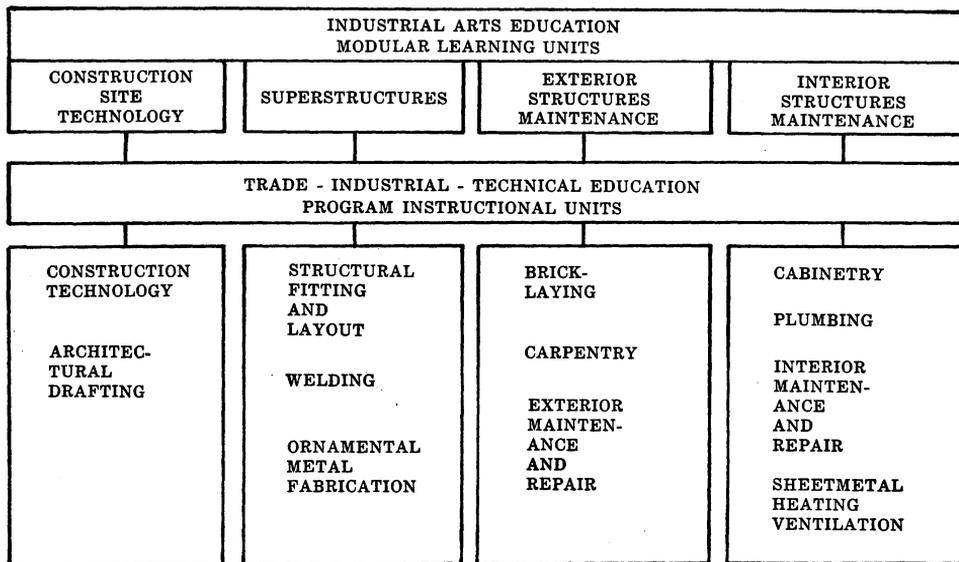


Figure 2. Performance Components of OVT Education.

CONSTRUCTION



INDUSTRIAL EDUCATION

MANUFACTURING

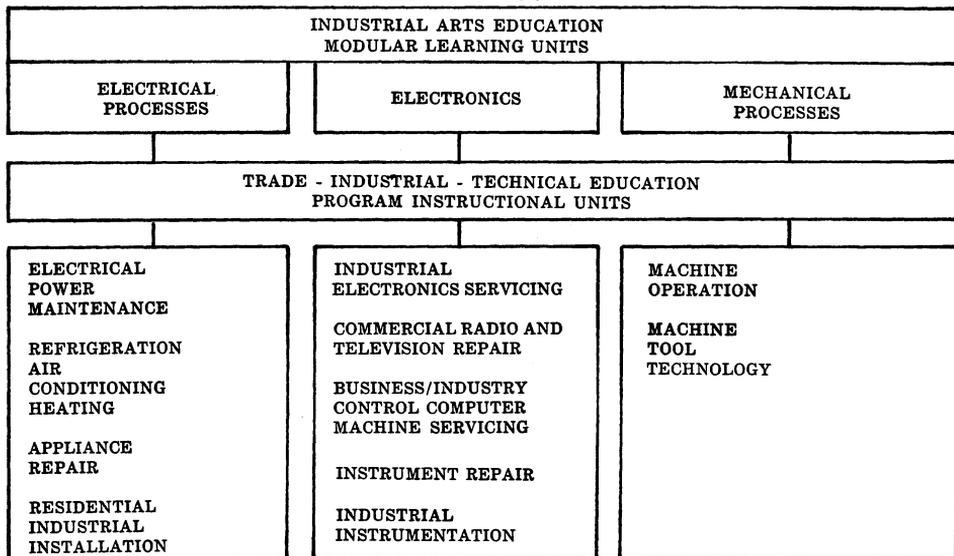
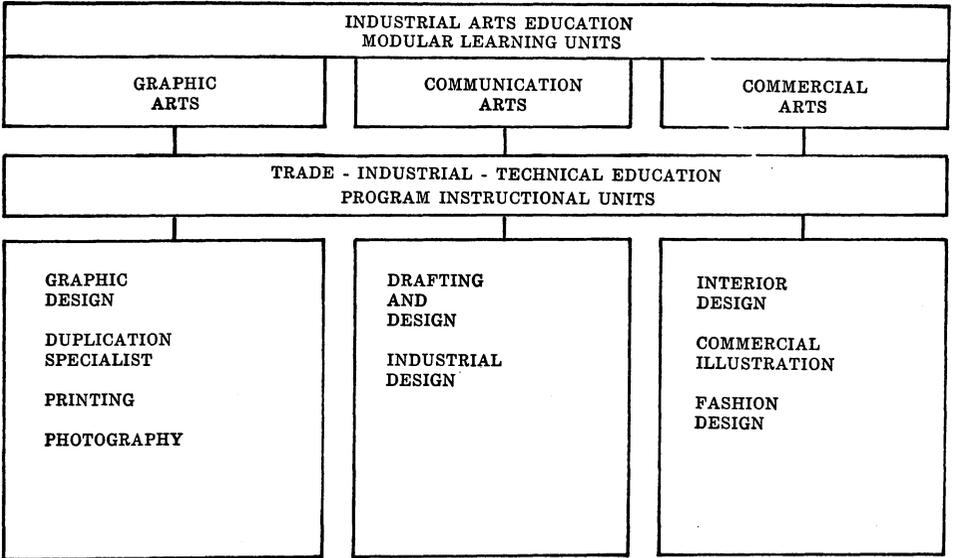


Figure 3. OVT Cluster Concept.

GRAPHIC COMMUNICATIONS



INDUSTRIAL EDUCATION

TRANSPORTATION

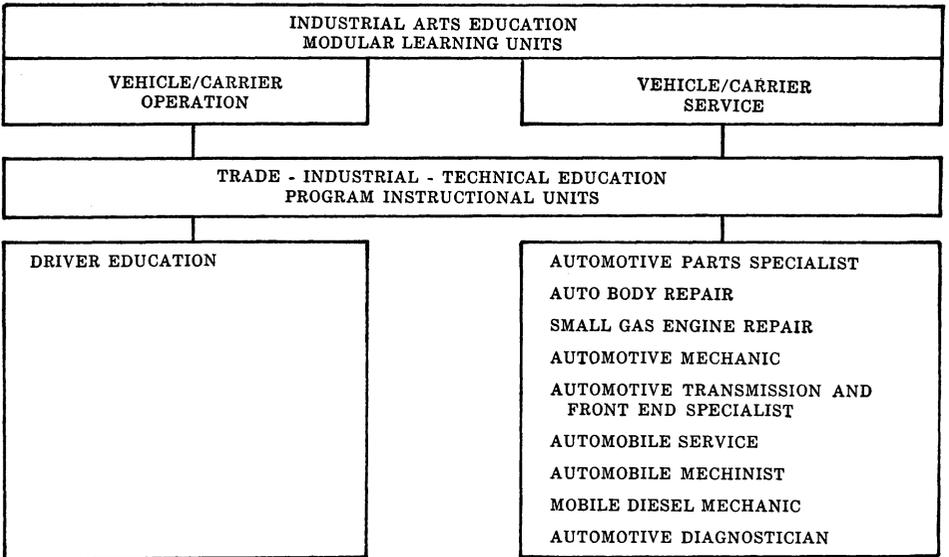


Figure 3. OVT Cluster Concept.

	Modular Learning Units
Construction Site Technology	27
Superstructure	31
Exterior Structure	28
Interior Structure	32
Vehicle/Carrier Operation	29
Vehicle/Carrier Service	41
Graphic Arts	30
Communication Arts	28
Commercial Arts	40
Electrical Processes	35
Electronics	36
Mechanical Processes	47

The modular approach allows for the discovery of modes of articulation between objects and events in the technological world. Seemingly unrelated objects can become related by an educational process that asks questions of experiences and by providing educational experiences in the environment that allow a student to discover and create for himself. Such a process in industrial arts allows a student to raise his consciousness about experiences to a level of explanation. This relationship allows the student to organize models of explanation for experiences that he is having in his environment.

The world is continuously being reshaped by technological accomplishments, some of which benefit man and others which do not. A senior high school student must have a sense of the complexity of the technological problems and some of the methods being utilized to solve the problems. Primary emphasis placed on goals rather than the tools should predominate in the educational process. Industrial arts developed in this way becomes a means rather than a separate discipline for examining the technological society.

Highly individualized programs can be devised by utilizing the skill oriented components of Trade-Industrial-Technical Education in facilities "duplicative of industry" as the students spend more periods or more years in a given sub-clustered area. Obviously, time is a critical factor; generally, the longer (more periods, more years) the student spends in the program, the more salable skills he can develop.

The degree of depth to which a person pursues a given area that has been clustered in the OVT program is an individual decision. Content makes no differentiation between useful knowledge and gainful knowledge because this can only be made by the individual.

There will be a new definition of work demanded in our society in the future. Virtually everyone of the 200 million people in our society will work—if the definition of work can be conceived of as the performance of useful activities. These activities must allow the individual to grow and develop and become an actualized person and a contributing member of society. In addition, efforts must be made to continually blend the reality of an entire operation (whole entities) in a program of studies.

The amount of time, length of the program, and sequence of presentation can vary, depending upon the students to be served. The teacher's role in this type of program becomes one of a facilitator who prescribes content for a given student after a diagnostic evaluation has been made. Students have options in this flexible type of programming from grades 9 through 12. He may begin at any time in a sequence to opt for more time and specific content in a Trade-Industrial-Technical Education program. The very fact that he may be spending more time in a specific program should allow certain students to exit from school with direct salable skills to enter the labor market immediately. If he wants to pursue one or more of the purposes identified earlier, the student may remain in an industrial arts program for the entire four years. Therein lies the desirability of comprehensive education: the right for students to choose and the flexibility to vary the time and the content of the program to accommodate the student's needs.

The facilities where the program is conducted and the equipment used in providing experiences may be identified as the "hardware" of the program. Facilities can range along a continuum from those that represent industrial experiences to those that duplicate industrial activities. In fact, industrial work experiences in the field must be included as an integral part of the program.

Industrial arts facilities designed to provide holistic program content are centered on a variety of hardware that is "rep-

representative" of industry. Facilities are designed and equipment is purchased to encourage students in activities that: (1) diagnose, (2) problem solve, (3) experiment, (4) test, (5) build relationships and (6) study concepts. In industrial arts programs for the senior high school, the development of skill in each of the cluster areas mentioned fosters rather than fully develops manipulative skill which can be transferred directly to production type activities.

Equipment and hardware is provided in trade-industrial-technical laboratories to duplicate activities that are performed in industry. When the objective for a student is to pursue direct entry into the labor market, 2 to 3 periods per day in grades 11 and 12 are spent in developing skills immediately transferable from the school laboratory to industry. One of the advantages of comprehensive education is that this type of facility is available and the program being pursued by an individual student can be adjusted as the student changes his program objectives.

In the thirteen comprehensive senior high schools of Pittsburgh the OVT facilities serve in a dual capacity. With adaptations to fit our unique program design, many of the facilities are geared for both industrial arts and trade-industrial-technical education functions. There can be vestibule clustered labs and specialized labs or a combination of the two. The vestibule clustered labs may be termed representative of industry while specialized labs duplicate industry. By separating the objectives which support cognitive skills from psychomotor skills it is possible to design labs to include the entire range encompassed in industrial clusters. Industrial cluster grouping merely insures that the range of equipment needed to provide skills is available.

Dual laboratory design provides for true heterogenetic student programming. Some classrooms will be designed to deal with students in groups in a smaller grouping and others as individuals. It is felt that the diversified range of equipment is more important than individually highly sophisticated pieces of equipment. It is not necessary for students to be working on equipment that replicates an industrial facility. Versatility in facility spatial planning is an important feature of the program in the senior high school. The industrial arts teacher who wants

to provide inter-disciplinary experiences and breakdown the fictitious barriers between all levels of industrial education can operate very successfully in versatile laboratories. Duplication of facilities can be minimized and many teams of teachers can teach in unit facilities that allow for frequent movement of equipment. It is important to re-evaluate the traditional design values and to look at the new dimensions in the overall concept of providing individualized instruction. Content and the method of teaching are less restrictive, thus the facilities to be constructed must be more adaptive to changing educational patterns.

### **OVT CURRICULUM/INSTRUCTION DIFFERENTIATION**

The long suit of the performance-oriented OVT program rests in the people who conduct the programs. For true communication to exist, the instructor must have competencies in both the cognitive and psychomotor domains. In addition, characteristics from the affective domain must be exhibited daily as the teacher interfaces with his students. Social and psychological factors must be examined carefully because in every way the social environment where the curriculum/instruction takes place is as important as the physical environment. As a result of the change in emphasis away from content and toward the individual, students can become more involved in activities that they consider realistic. To manage educational programs geared toward solving identifiable problems and needs, new and innovative ideas must be infused into the process. These ideas come from people who are not fearful of change and desire to manage the differences between the past and present in relation to technology, institutions, and ideologies.

#### **Competence**

The activities that are provided in a given program allow for a sequential progression of technical content over a given period of time, with varying degrees of allowance for skill development through laboratory experiences. If indeed it is a fact that success breeds success, then it is the educators' task to put together a series of activities and a climate for learning in which students can succeed. It's not particularly important

how closely that climate duplicates industry, but activities must be arranged in such a way that they provide successful experience permitting success to become a habit. Learning activities usually involve the accumulation of knowledge and the use of this information or knowledge to respond to some stimulus provided in the activity.

The accumulation phase of education has been termed by some as learning, and the subsequent use of the knowledge as performance. The degree or depth of skill which an individual develops aids in determining the preciseness of expectation for student output.

### **Trust**

Industrial arts taught at the senior high school level has the potential of serving several needs in the educational system. It had always been asked to fill an existing void in the program offerings because it was "practical." Now, by design, the teacher and the student together have the capability of making decisions as to where exploring the specific field ends and skill-centered development of competencies begins. This decision process requires personal commitment to the goal of self-actualization both from the teacher and the student.

### **Respect**

The answer as to which program direction should be developed is highly individualized and dependent upon many variables contained in the educational process between the student and teacher. Program content is comprised in industrial arts on a continuum and it is virtually impossible and needless to draw a definite line between each of the functions the discipline can perform at a secondary level. Anything short of the ability to alter and adjust directions for industrial arts would be unrealistic because our society today is a human-oriented one, demanding interrelationships and interdisciplinary thinking. This is as true in sciences and technologies as it is in our economic/social and human development.

### **Perception**

Students want new experiences; they desire to seek and discover for themselves. The primary role of the teacher then is

to make himself superfluous as he imparts a means of gaining knowledge for and by one's self. Discovering through a controlled environment may be used as a means of guiding learning, of managing, facilitating and organizing content. This may mean delaying gratification but it involves processes of positive attitudes towards self which an individual may expand to future problem solving.

Perception allows for the humanization of the learning process without the reduction of any standards or competencies in the content area that are expected by parents or the community at large. Often times, however, the coordination of the various components of education is like playing the game of "who bells the cat?" Educators believe in the theory of humanization but everyone wants the other guy to do it.

### **Sensitivity**

Industrial arts education cannot afford only to philosophize. Industrial arts must provide realistic, functional programs at the senior high school level. Likewise, it cannot afford picayune efforts that lack leadership and are supported by only small amounts of resources. In establishing a new direction one must re-examine the total learning community beyond the formal school and utilize it in establishing plans. We must be forthright and candid with all the many groups who have a legitimate interest in the activities of education generally and industrial arts education specifically. Every opportunity must be given to allow people to say what they are for rather than what they are against.

By placing a great deal of emphasis on the human element it is realized that every student can be served and that everyone has talents. These specialized gifts must be the framework within which educational programs are designed.

Many in our society resist the effort that goes into diagnosing the talents of individuals then prescribing programs for them. Kids are different, not necessarily inferior or superior. One who is attempting to relate to them must understand as much of their culture and background as is possible. Materials must be designed to promote respect and understanding for and of different groups of individuals as well as provide for self-awareness and pride in self. Sensitivity to the ways that stu-

dents react and respond to each other, as well as to the teacher, is extremely important. This change in attitude toward people can provide a framework for educational programs. The program can, in fact, be the cognitive and affective map—something to believe in idealistically and to produce operationally.

### **Loyalty**

An open-ended and pragmatic program is necessary for the development of the child as he grows intellectually, emotionally, socially, aesthetically, and physically. Planning for students should be congruent with stated educational goals, values and beliefs of our society for a given time and for any given group of students. In OVT there is a great respect for individuality and mutuality among members in the educational process. Internal student needs of appreciation, acceptance, understanding, recognition, motivation, and provision for self dignity are equally as important as the performance goals which are developed. The teacher's role is one of constantly pointing out the practical significance of education as well as pointing out cognitive perception and verbal skills on which education is based.

The industrial arts program in the senior high school must allow the student to grow to maturity in technological literacy and career literacy about the business/industry world. Maturity, characterized by tolerance for ambiguity, and the ability of the individual to possess inner strength and commitment about personal goals and values will allow the individual to act in a responsible manner.

### **Guidance**

In the OVT Division, we are less concerned with definite program boundaries, with rigid stipulations, and are more concerned with stressing interpersonal relationships, communications and a new set of values.

Students participating in industrial arts programs at the senior high school level will be asked to utilize their own individual and highly personalized style and also to integrate that uniqueness into the group that is involved in the learning process. The group will undoubtedly be heterogeneous and different.

Many students will exhibit many different difficulties in achieving in the learning environment. Specific counseling help must be provided with the intent of improving performance. Students may need to develop more effective study skills or apply the skills they have developed more consistently and productively to their study assignments and laboratory activities.

### **Assistance**

Content is organized in such a way that it identifies the performance expected of the student rather than stating instructional goals in terms of the subject matter. The performance contract states what the student must be able to accomplish at the completion of the program rather than concentrating on subjects and topics that focus on subject matter as opposed to the interrelationship between the student and teacher. In this way, materials, means and curriculum become inseparable. The teacher's time can be devoted to discovering better ways in shorter time spans to meet individual pragmatic needs of the students.

The content derived from looking at an expanded work content is only part of what must occur in the educational process. The profession must be viewed as a helping profession. Researchers tell us that the methods that are used do not make a great deal of difference but other factors—honesty, trust, rapport with students—are the things that carry high priority for future learning and living. We need to encourage a resiliency within students to realize that an individual's limitations should be as well known to himself as are his strengths. We need to emphasize learning to cope if industrial arts is to continue to be future-oriented.

### **CONCLUSION**

Industrial arts in some secondary schools has struggled to be competitive and maintain a status with other disciplines. Its role is unquestioned in Pittsburgh's OVT program because of the contributions made for large numbers of students. Industrial Arts in Pittsburgh is designed to (1) open up more and more practical opportunities for significantly large numbers of students; (2) emphasize that the student must learn to learn; and (3) provide offerings that create understanding and develop

skills in working with others. In this manner Industrial Arts Education does not have to be directed solely toward an occupational function of earning a living but, in many instances, may be directed toward total living.

The definable goals of Industrial Arts are, for the most part, human-oriented. Establishment of objectives that serve students is clearly more important than the separate components or disciplines that comprise an educational division. In this context the controversy regarding the role of industrial arts in relationship to vocational education in the senior high school becomes non-existent as the best of both philosophies is blended to serve students. In the battle between industrial arts and vocational education for prestige and visibility, the hurdles are viewed merely as management problems and not as philosophical issues. The development and management of plans for the functioning of industrial arts in the senior high school in Pittsburgh has gone far beyond straight line extrapolation of the past and repetition of prior programs. Many objectives have been reached because imaginative planning was implemented and a candid analytical process of evaluations, based on student results, became a continuing process.

## REFERENCES

- Allen, Dwight and Peter Wagschal, "Differentiated Staffing For Vocational-Technical Education," The Center for Vocational and Technical Education, The Ohio State University, Columbus, Ohio, October 1968.
- Bjorkquist, David, *What Vocational Education Teachers Should Know About Individualizing Instruction*, Information Series, No. 49, VT 013 713, ERIC Clearinghouse on Vocational and Technical Education, November 1971.
- Cohen, Wilbur J., "Education For All Must Be American Goal," *Michigan Association of School Boards Journal*, March 1969.
- Coleman, James S., "The Children Have Outgrown The Schools," *Psychology Today*, February 1972.
- Crockett, William J., "Team Building-One Approach to Organizational Development," *The Journal of Applied Behavioral Science*, Vol. 6, No. 3, 1970.
- Dauwalder, Donald D., *Vocational Education in the Pittsburgh Public Schools*, The Pittsburgh Board of Public Education, April 1963.
- Erickson, Kenneth J., "The Open Laboratory Instructional Technique," *Journal of Industrial Teacher Education*, Fall Issue 1963.

- Gallington, Ralph O., "A Space Concept for New Approaches in Industrial Arts," *IA/VE*, March 1966.
- Gallington, Ralph O., "Industrial Arts for The Disadvantaged," *American Vocational Journal*, November 1967.
- Gerrish, Howard H., "A New Shop Philosophy for Industrial Arts," *American Vocational Journal*, January 1966.
- Ginzberg, Eli, "Vocational Education Is Not the Answer," *Phi Delta Kappan*, February 1971.
- Henderson, Kenneth B., "Telling Methods versus Heuristic Methods," *Handbook of Research on Teaching*, The American Education Research Association, N.L. Gage, Editor. Chicago: Rand McNally & Company, Chapter 19, p 1014, 1963.
- Kolb, David A. and Richard E. Boyatzis, "On The Dynamics of The Helping Relationship," *The Journal of Applied Behavioral Science*, Vol. 6, No. 3, 1970.
- Kugler, Harold L., "Self Examination For Public Education," *American Vocational Journal*, November 1967.
- Lockette, Rutherford E., "What Research Has to Say for Content in Industrial Education," *NAITE, Journal of Industrial Teacher Education*, Vol. 2, No. 3, Spring 1965.
- Mason, Emmett E., *Industrial Arts Curriculum Improvements: A Change Agent's Guide*, Information Series No. 35, VT 012 875, ERIC Clearinghouse on Vocational and Technical Education, August 1971.
- Olson, Jerry C., "Curriculum Implications for an Educational System that Meets the Needs of Disadvantaged Students," National Workshop on Vocational Education for the Disadvantaged, Atlantic City, New Jersey, March 1969.
- Pearce, Lucia, "Environmental Structure: A Third Partner in Education," *Educational Technology*, September 15, 1968.
- Randall, Ronald and Charles Blaschke, "Educational Technology: Economics, Management and Public Policy," *Educational Technology*, June 1968.
- Rogers, Vincent R., "Open Schools On the British Model," *Educational Leadership*, Journal of the Association for Supervision and Curriculum Development, NEA, February 1972.
- Tuckman, Bruce W., "The Psychology of the Culturally Deprived," *American Vocational Journal*, November 1967.

SECTION VI

**Senior High School  
Industrial Arts Programs:  
A Study of Technology**

# Education in a Technological Society: “Access to Tools”

*Paul W. DeVore  
Professor of Industrial Education  
West Virginia University  
Morgantown, West Virginia*

Those who engage the question of education agree generally that definite relationships exist or should exist between a given culture, a society or a class within a society and the type of education or training provided people within a given classification. In the past, there was considerable continuity of educational programs. The nature of the social/cultural milieu provided the rationale. There were, of course, discontinuities in the equation. But these were of minor consequence. However, today the equation has a new and more powerful variable which must receive consideration if the equation is to be balanced in human terms. This new variable is the phenomena called technology, a phenomena which affects directly all levels of education and particularly those questions directed toward the role of education at the senior high school.

Just how important is this variable? What is its nature? In what way does it affect the educational equation? What other variables must now be considered because of the increasing sophistication of man's technology? Are we at that stage

---

Reprinted by permission with revisions from paper presented to Southern Science and Technology Forum, The University of Southampton, England (September, 1971).

of technological development where psychological variables, including values and attitudes, become more critical elements in the education equation than scientific knowledge and technological literacy, both for the individual and society?

Civilization may be at a new stage of development where new questions must be formulated about man, society, technology and education. One does not need to engage the questions for too long before it is recognized that the technology of today is totally different from the technology of yesterday. Technology today has great power and potential for man, both creatively and destructively. The advent of the cybernetic age has brought forth new questions for man about what it means to be free and a human being. The potential is available for placing absolute control in the hands of a select few. Thus, the social and human implications of modern technology are the most critical of any questions about education in a technological society.

The purpose of exploring the question of education in a technological society is to begin the identification, analysis and synthesis of the issues as a base for establishing alternative educational directions at all levels of educational endeavor which best meet the needs of individuals and societies at various levels of technological development.

### THE CULTURAL ELEMENT

Man's perception of reality is a function of his culture. Throughout the history of civilization, man has altered his concept of reality by changing his culture. Today we realize that man has changed his culture and his reality through the creation and development of technology. Gradually we have become aware that man's life style and his concept of reality have been progressively altered and controlled by this ever expanding phenomena.

It is interesting, however, that most people are not aware of their own culture. It is something which becomes a part of a person without his awareness.

For instance, technology is a part of our culture today. It has, of course, always been a part of civilization at some level of sophistication. The fact that today we speak of technology as a phenomena within our society presupposes our awareness of

it. Yet, in earlier times, technology was no more than one of the many elements that formed the fabric of civilization. Not so today!

It has become a phenomena within society which more and more directs and shapes the total culture, and perhaps, for the first time in the history of man, a cultural element has elicited awareness on the part of many and not only a few.

This awareness has come about because of the wide spread social consequences of technology as a powerful disruptive force within our society. Rather than being one of many factors within the cultural fabric of society, technology has emerged as a dominant factor altering the options, choices and potentials of man and society. The new choices, alternatives and options resulting from this new phenomena have changed many of our basic assumptions about man, society and education. For instance, the impact of actions by man, utilizing his technology, are no longer local. Decisions and actions impact upon entire societies with unforeseen consequences. What was once a concern of a few, now, more than ever before, becomes a concern of many.

Technology has become, almost without our awareness, an all pervasive factor in the affairs of man. We have gradually become aware that the technology of earlier eras of civilization was entirely different from the phenomena of today, both in the tools and the social consequences of the use of the tools.

### **CHARACTERISTICS OF TECHNOLOGY**

One need compare only a few developments in technology to be aware of their impact and the differences generated between earlier industrial revolutions and today. Consider the tools of navigation as an example. The juxtaposition of the magnetic compass with the development of space navigation, requiring a computing capacity beyond the ability of the human brain, shows the difference is not only quantitative but qualitative as well. The comparison of moveable type with modern publishing based on the computer, optics and automation illustrates the differences as well as the new potentials, together with the rapidity of change. It seems as though the very nature of the phenomena shifts as we attempt to study it.

It is possible, however, to attain some understanding of the phenomena by studying selected characteristics at different levels of development. When we do, we become aware of critical differences in the evolution from primitive and craft technology to modern or contemporary technology. The *behavior* and *effects* have been, and are, distinctly different at each stage in man's history.

During the primitive and craft eras, technology was a part of the culture but not a dominant factor. Man had technologies but they were mostly local with little technical information communicated between groups. Early man applied his technology in limited areas and only a small portion of the day was given to technology. Whether man adopted a new technique or technology was a choice he could make. Also, as we know from the history of technology, the primitive and craft eras evolved slowly. Man had time to adapt as he discovered new ways of doing, thinking and acting and as he engaged the creation of new possibilities and the determination of *what was to be*. The impacts of technology upon man and society were minimal, and the time, speed or distance required for a given event to reach a critical mass was insignificant compared to today.

Modern technology, however, based on the collection and organization of knowledge, the systematic analysis of knowledge and the publication and wide distribution of knowledge has not just altered the equation; it has created an entirely new equation with many new variables, new realities, new options, new alternatives and new choices.

The technology of today is a different phenomena from the technology of our recent and distant past. Today's technology requires an interconnecting network of supporting services—mandating new skills, new occupations and new social patterns. The new technology has created a pluralistic society of great diversity, while at the same time giving primacy to unity, process, information, learning, knowledge and interrelationships. There is a tendency for all people everywhere to apply the same procedure to the solution of technical problems, thereby creating a universalism.

The increasing power of technology, the rapidity of change and increasing populations combine to form an explosive, disruptive force within society creating consequences we can only

imagine. In earlier times, technology was largely an individual matter with individual choices impacting on other individuals within specified environments; today, the consequences of individual decisions and choices coupled with the power of technology have created and are creating social and natural disasters. The time to reach a critical mass has been shortened and the reaction more like electromagnetic waves with many consequences in different locations and at different times. The establishment of equilibrium is more difficult.

### TECHNOLOGY AND EDUCATION

Institutions such as education, created in earlier times, fail to adjust and for obvious reasons. The institution of education was created to provide stability and equilibrium within society. However, it has become a mismatch and, in some cases, a liability both in developed and developing countries. Education, tied to tradition and the status quo, provides its future citizens with the tools of another era and many times denies access to the tools required to function effectively in a modern technological society. This is done by the very institution that is charged by society to prepare people for living in their culture, a technological culture. Why is this so? The answer is rather obvious.

Many, is not most educators treat technology as something apart from the daily affairs of man. By doing so they turn the control of a powerful tool over to a regime of experts. They deny their students access to the very knowledge and tools so vital to creating, managing, regulating and directing technology for their benefit as well as others. They visualize technology as an "object" and not a "subject," as something "out there" but not really important to life and living and thus inappropriate for study. It seems that educators are not aware of technology, let alone engaged in the study of it. They insist on the study of the behavior of plants, animals, molecules and the history of man politically but not technologically. Technology seems to be an abstract man has created which exists outside the sphere of the awareness of educators.

One result of this separation of technology from life is the alienation and estrangement of man from society. Man has become alienated to a world which is unresponsive to him. He

is faced with a technological world evidencing a scope and complexity he cannot comprehend. Modern technology and its tools require other than common or folk knowledge and understanding if they are to be responsive to man, as were the tools and techniques of earlier times.

Technology has been one of man's main modes of expression. Yet today great masses of people are denied access to its tools. The tools of technology have become the property of experts and are under their control. Thus, the sophisticated tools of technology and the knowledge of how to use the tools have become a commodity, bought and sold on the market place to the highest bidder. The control of society has been gradually placed in the hands of a select few, thus alienating great masses of our citizens because of the unresponsiveness of the tools and the system to their needs and desires.

What one begins to understand about the technology of today is that it is and has been created and controlled by some men, not all men. In addition, the common man and many of his institutions perpetuate a narrow or restricted perception of technology, if not a false conception based upon realities that no longer exist. There may be, as Skolimowski (p. 35) suggests, several conceptions of technology best understood as a series of concentric circles with the smallest circle representing the narrowest or most restricted view of technology.

One's level of technological awareness and perception can be conceived as an expanding order of increasing complexity. Technology can be described as:

1. The totality of all man-made tools;

or

2. The totality of all man-made tools and their function and use;

or

3. The totality of all man-made tools, their function and use and the material results of their application (technological products) ;

or

4. The totality of all man-made tools, their function and use, the material results of their application (technological products) and the social impact of these products;

or

5. The totality of all man-made tools, their function and use, the material results of their application (technological products), the social impact of these products and the influence of technological change on the life of particular individuals and societies and groups.

It is evident that most institutions within society, including education, conceive of technology in a restricted sense, primarily in categories one and two, with an occasional recognition of category three. Thus, most school programs satisfy their perception of technology by offering courses in tool using and material processing based on the era of the early industrial revolution or by pursuing programs in occupational training or career education.

The low level of awareness and interest in technology, coupled by indications of resignation or alienation on the part of students and citizens, portends future social and political changes that may be irreversible.

Educational institutions have, for the most part, rejected the study and investigation of one of man's most creative intellectual endeavors—technology. Over the years, the evolving technology, with a new and expanding knowledge base, has transcended most educational efforts and the competence of the average citizen. Although we study politics, poetry and philosophy for the purpose of understanding our culture and ourselves, for some reason we reject the study of that phenomena within our culture which is the prime force in shaping our social milieu.

#### **INSTITUTIONAL AND SUBJECT CONFLICT:**

Education and technology are in conflict. Technology is supposed to improve man's life but it does so only by disrupting the continuity of society by systematically creating change. Education, as an institution, aims at continuity and stability. Traditionally, education has stood at the gates, preserving tradition and culture, while man pursued the evolution of his technology outside the gates through innovation, invention, discovery, and risk.

If institutions, such as education, moved in perfect harmony with the society and its evolving technology, there would be no

conflict. But this has not taken place. The position of educational programs and systems has become untenable because of advances in human knowledge. The problem is one of perception on the part of those within society who manage the institution of education.

Man has created new tools. He has altered his potential. He has made it possible to do things differently. In doing so, however, he has created many discontinuities. And education as an institution, rather than reorganizing to take advantage of the opportunities for man and society created by the development of new tools, seems to have structured itself to resist change.

It is interesting to note that during the establishment of programs of education for the common man, education was a disruptive force within society. The young became educated and teachers of their parents, creating a "younger generation" in conflict with an "older generation." Today, education is disruptive, not because it leads and provides the knowledge and tools necessary for man to engage life and living in a technological society, but because it lags and deprives. Education has become, for many, a sterile existence. Rather than freeing man, it has enslaved him and made him unfit and unprepared for life and living in an age of cybernetics and unprecedented potentials. The educational system has muted man's awareness of his ignorance and pursued the policy of machine-tooling him into a marketable commodity in a narrow speciality.

Schooling, Illich notes, has turned knowledge into a commodity and denied man access to reality by denying him access to the tools of his culture. And we find, as we study the Man-Society-Technology equation, that knowledge of social, psychological and technological systems, together with access to tools and the know-how in their use, are absolutely essential if man is to control his environment, establish equilibrium and attain his full potential as a human. It is, therefore, absolutely essential that education in a technological society provide access to tools and reality.

### ACCESS TO TOOLS

Today man lives in and is continually exposed to the technological environment. Yet, many lack a true understanding and

comprehension of this environment. Some even take pride in not knowing about technology. They treat technology as if it were an object, something to be handled and manipulated as the early craftsman handled and shaped a piece of wood or metal. As a consequence, Koestler maintains, they "utilize the products of technology in a purely possessive, exploitive manner without comprehension or feeling." In the process, technology has become alien to man and he has been alienated by it. Many conceive it as unnatural and artificial. They have no control over their lives in this strange environment because they do not know what the system is. Nor do they have the required knowledge and access to the tools. They have acquiesced. They lack interest in and an accurate perspective of the new environment. They take a pride in not knowing. And this psychological cover-up contributes directly to their loss of access to the tools and knowledge of the technological society. Without access to tools and without knowledge, man effectively loses control of his technology. And the institution of education, through its restricted vision of reality, perpetuates the system of ignorance through its pride in not being involved with technology and the new reality. Thus we create and continue to develop citizens entirely dependent on science and technology, but ignorant of both. The system creates, as Koestler notes, men who lead the *life of urban barbarians*, totally ignorant of the culture which supports them.

Man does seem aware, at least superficially, that civilization has progressed in the last hundred years or so from an agricultural society to an industrial-technological society. He is, however, unaware that the change which has taken place is more than a change in the outer appearance of tools. An entirely new phenomena has been created.

Skolimowski stresses the difference between Technology with a capital "T" and technologies with a lower case "t." "Technology," he notes, is a specific embodiment of technologies and its fundamental characteristics cannot be grasped by examining the features of particular technologies such as welding technology or vacuum forming technology. The whole is thus greater than its parts. This means that man must develop a new perception, a new mentality, if he is to control the new Technology for the benefit of all men and not a few men. It means

that we must redefine the function of education and that our educational system must be restructured and focus on questions of the *behavior and control of Technology for man*, rather than the question of the behavior and control of man for technology through occupational training and career education.

Some men, those who created and developed the technologies, comprehend and understand the physical forces and principles which provide stereophonic sound, linear induction motors and color photography. They know and understand and can control these devices. But the issue is not the control of a single technical device; the issue is the understanding and control of the behavior of Technology as a major force for change within society. It is not only the study and comprehension of the behavior of the technical elements, but the social/cultural elements as well. In essence, it is the solution of the Man-Society-Technology equation. It is a study of the *behavioral characteristics of technological systems*. The concern is with the dynamics. It is not a concern of what a thing *is* but what it *does*. It is an attempt to gain knowledge, to gain control and thereby attain mastery over the tools of Technology for man.

The aim is control, to turn uncertainty into risk, to be able to predict the consequences of our actions in the use of Technology. Technology can be a powerful tool for man if he is educated in the use of the language and the tools. The complexity of the problem is immense and can only be solved when man develops an awareness and comprehension of the behavior of social, psychological and technological systems and the interrelationships. He needs to become aware of the behavioral consequences through *if-then* statements. Finally, he needs to consider not only the question of controlling Technology, but of controlling his own actions as a critical element within the system. For only by disciplining himself, as well as Technology, can man become free.

There is a direct relationship between man's tools and the satisfaction of man's needs—from the most basic physiological needs to the attainment of self-actualization. Man has altered his potential for attaining an ever higher level of need satisfaction as he has changed his Technology. He has altered his potential for becoming more human. However, denial of access to the tools of the new Technology and to the knowledge neces-

sary to utilize the tools limits man's potential of becoming a full human being. Yet, man's access to the tools of modern Technology has been limited, and for many, denied entirely, as have the skills and know-how for the effective utilization of the tools.

Man is many times denied the freedom to conduct his own education and shape his own future because the tools which aid the process are scarce and limited to a few. Technology, it seems, has become too important to trust to man. Man's tools, Illich (p. 48) reminds us, have been socialized without consideration of the question of the socialization of knowledge and know-how in their use. The control of tools, such as the computer, has passed quietly and effectively to a few who have created special organizations that "render access to know-how formidable and forbidding." (Illich, p. 48)

Man is thus alien to the very element within his culture which can aid him in reaching his highest level as a human being—his Technology. Not only has man acquiesced and permitted his tools to be socialized but he has permitted his thinking to be socialized also. He has created institutions called "think tanks" which do his thinking and planning for him. Decisions, it seems, have become too important to trust to the general public.

Thus, even before the general public has become fully aware of new developments, the technocracy has doped them out and laid its plans for adopting or rejecting, promoting or disparaging. (Roszak, p. 7)

The urban barbarian, created by an educational system which denied him access to knowledge and tools and muted his interest and awareness, is effectively shaped and controlled by those in command of the tools and knowledge of the new Technologies. Technology has become less and less responsive to his needs and those of his society. He is a part of the enterprise but not a participant.

### **PARTICIPATORY TECHNOLOGY**

What is the solution to the dilemma man has created for himself? Carroll (p. 647) suggests participatory technology. He believes participatory technology is one way of making Technology more responsive to the felt needs of individuals and society by:

. . . the inclusion of people in the social and technical processes of developing, implementing, and regulating a technology, directly and through agents under their control, when the people included assert that their interests will be substantially affected by the technology and when they advance a claim to a legitimate and substantial participatory role in its development or redevelopment and implementation.

The concept seems valid but will not work in our present society. It will not work because the great mass of our citizens are not educated for participation. Their role as non-participants has been instilled effectively by the educational system. To participate effectively requires that an individual have faith in himself and fundamental knowledge about technology and technological systems.

Participatory technology presupposes freedom, knowledge, and tools; freedom to act and knowledge and tools with which to act. These are the preconditions, it seems, if man is to again become part of the process with a sense of intelligent participation and not alienation.

### PHILOSOPHY, VALUES, ATTITUDES

The problem also involves the question of man's attitude toward life and his purpose for being. It is a question of philosophy and values. Today, the value which permeates the entire society is *progress*. There is a fixation on progress. Man believes, as Bently Glass states, that man cannot really enter a *Golden Age* of equilibrium but, because of his nature, must face new challenges and quests and Endless Horizons if he is to avoid boredom. Glass believes the Golden Age would soon look tawdry if there were no Endless Horizons. He does, however, question whether endless progress is possible, and if not, calls for a man who can transcend his present nature and live in a society in equilibrium.

Most scientists and technologists are progress oriented. They see progress as the only solution to increasing the quality of life for the millions of poor. They believe that bigger systems, more powerful tools, and better communication systems will produce more, until ultimately there will be enough left over to share with the poor. (Ehrlich, p. 46) They do not conceive technology in the control of the common man or the use of technology by the common man to understand his environ-

ment better, to shape it with his own hands and to attain full intercommunication to a degree never before possible. (Illich, p. 48)

The focus, rather, is on the use of technology for the control of other men rather than the control of technology for the benefit and self-actualization of all men. We have developed the attitude that the "good life" is attainable only when one is in a dominant situation. (Landers, p. 224)

The fact that societies tend toward consistency, harmony, balance and equilibrium seems foreign to current thinking. Yet, the question of control is not a question of dominance. It is a question of knowledge about the behavior of systems. It is a question of homeostasis, of equilibrium. It is a question of attainment of given conditions. It is a question of symbiosis as it concerns the Man-Society-Technology equation and the natural environment. It is a question of relationships and consequences among elements. It is a question of choice, both quantitatively and qualitatively, as it affects man's life and living. It is a question of direction and of behavior to attain a given direction. Control, therefore, is ultimately a question of philosophy and values about Man-Society-Technology.

### NEW TOOLS—NEW CHOICES

The power and potential of technology—both creative and destructive—have presented new problems to man with respect to his philosophies, his values and his institutions. The result is that some men are questioning their concept of progress. They have found that progress can be measured by a number of dimensions—political, social, cultural and spiritual as well as economic. (Thurow, p. 45)

It has also been determined that technology can be utilized in many different ways—that man has a choice. Although some have lost faith in knowledge and technology and would abandon the intellectually rigorous life and return to the supposedly more tranquil and certain existence of early agriculture, others favor the redirection of technology to meet genuine human needs. (Ehrlich, p. 46)

The issue seems to be one for which education has not developed successful alternatives. Most educational programs have focused on the past, the here and now and on meeting

rather specific vocational and occupational needs. The problem, however, is one of preparing people to engage the question of determining meaningful social policies for the future. It involves, as Brzezinski states: "*the explicit definition of social purpose.*" (p. 309) What is being asked is that man engage in questioning that which he has taken as a given, the future of man and society. This requires a new mentality, a different way of perceiving. It requires that all men involved in determining the questions and their answers have knowledge and tools adequate to the task. It means a comprehension of the concept of system and the understanding that everything affects everything else. The new mentality requires a comprehension of problems and issues in terms of systems, interactions and interrelations. The goal of education should be to provide individuals with the means to find order in a complex universe and to attain the knowledge, skills, tools, attitudes and values required to participate successfully in deciding the future.

Central to establishing new programs of education which will provide access to knowledge and tools necessary for determining and controlling the future is the question of implementation. Schon (p. 47) stresses:

We have spent intellectual energy on invention and research, on the development of new social policy, and on the critique of existing social policy, whereas the issues before us have been centered around our incompetence to carry out any programs of change at all.

We do not know how to engage in change. We do not know how to make decisions. We do not know how to move from problem, to solution, to action in the establishment of meaningful social policies. Our educational systems protect the status quo. They are not concerned with change or education for change. This kind of attitudinal and value orientation, directed to the preparation of people, not as citizens deciding and capable of action, but as career-oriented workers incapable of action, portends serious consequences for the future—a future in which the power and potential of technology continues to increase and the proper functioning of each and every part becomes more crucial to the whole.

Citizens deprived of knowledge of the Man-Society-Technology equation, denied access to tools and educated for non-participatory roles cannot be involved in solutions.

Yet we maintain the myth of a democratic technology at a time when the consequences of choice by each and every citizen become more and more critical. We encourage individual participation without providing the knowledge or tools to make intelligent contributions. We make social decisions in the use of technology without adequate information. We follow procedures used when technology was less powerful and the consequences less final.

*If* we believe that we, as citizens, should participate in determining the future of society, *then* we must educate ourselves to do so. The system is too complex, interrelated and interdependent not to do so. And the characteristics of a technological society indicate the equation with respect to error and failure has been greatly altered. Failure in a complex modern society is of far greater consequence than in earlier societies. In earlier times the technology was not as powerful, dependency on multiple subsystems not as great. In earlier times if the system was disturbed, it returned to equilibrium in a relatively short period of time. Today, this is not true.

. . . our very survival becomes dependent on the absence of failure in the major sub-systems on which society depends. Among them are power, communication, transport, health services, food and peace keeping. (Branscomb, p. 974)

### CHOOSING A FUTURE

Technology has always provided man with new choices and more options. Increasingly the consequences of man's choice of options has been more critical and more final.

Today, there are many options associated with the phenomena of technology and the institution of education. The options, however, involve philosophical questions, not technical. The options concern values and direction and can be arranged on a continuum and developed into a series of *if-then* statements dependent on the choices made.

When this is done, the issue is greatly simplified. The question becomes one of control; its nature and range of participation within the population. It is a question of the control of the behavior of the system in attaining equilibrium within the technological system rather than immobility and regression or disruption and ultimate destruction.

The criterion for judgment is man and his level of participation within the system. It is a function of choice based upon assumptions about the nature of man, the nature of society and the nature of technology. (See Figure 1.)

If we can locate our desired level of participation on the "continuum of choice," then we can determine the quantity and quality of our options, freedom and control. Our choice will determine answers to such questions as:

1. The degree of socialization and control of tools.
2. The degree of socialization and control of knowledge and know-how.
3. The character and behavior of educational systems.
4. The character and behavior of technological systems.
5. Man's level of options, freedom and control.

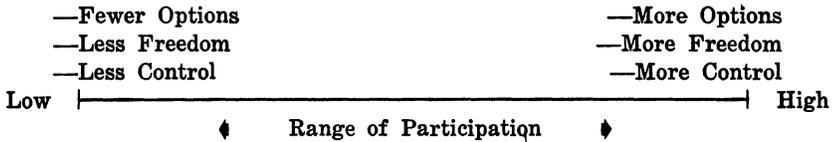


Figure 1. Continuum of Choice

The character and nature of education and technology are thus a function of choice.

If we choose answers which direct our energies toward more freedom, more participation and more options, then it is imperative that education, at all levels in a technological society, incorporate the Study of the Behavior of Technological and Social Systems, provide access to the tools of technology and aid all citizens in obtaining the knowledge and know-how necessary to pursue these goals to the level required for the system to function most effectively; and for man to attain the most humane existence ever.

Regardless of the position we choose on the continuum of choice, if education as an institution is to meet the needs of citizens in a high technology society, it is imperative its stance be altered and rather than direct attention to the past and *what was*, or the present and *what is*, that the focus change to the future and *what is to be*.

## BIBLIOGRAPHY

- Baram, Michael S., "Social Control of Science and Technology." *Science*, Vol. 172 (May 7, 1971), pp. 535-539.
- Bendix, Reinhard, *Embattled Reason: Essays on Social Knowledge*. New York: Oxford University Press, 1970.
- Bennis, Warren G., "The Failure and Promise of the Social Sciences." *Technology Review*, Vol. 73, No. 1 (October-November, 1970).
- Berger, Peter L., and Brigitte Berger, "The Blueing of America." *The New Republic*, (April 3, 1971), pp. 20-23.
- Bock, Philip K., *Modern Cultural Anthropology*. New York: Alfred A. Knopf, 1969.
- Bowser, Hallowell, "The Eggomaniacs." *Saturday Review*, (July 18, 1970), p. 20.
- Braden, William, *The Age of Aquarius: Technology and the Cultural Revolution*. Chicago: Quadrangle Books, 1970.
- Branscomb, Lewis M., "Taming Technology." *Science*, Vol. 171 (March 12, 1971), pp. 972-977.
- Brzezinski, Zbigniew, *Between Two Ages: America's Role in the Technetronic Era*. New York: The Viking Press, 1970.
- Carroll, James D., "Participatory Technology." *Science*, Vol. 171 (February 19, 1971), pp. 647-653.
- Drucker, Peter F., *The Age of Discontinuity*. New York: Harper and Row, 1968.
- Ehrlich, Paul R., and John P. Holdren, "Technology for the Poor." *Saturday Review*, (July 3, 1971).
- Faban, Don, *The Dynamics of Change*. Englewood Cliffs: Prentice-Hall, Inc., 1967.
- Forbes, R. J., *The Conquest of Nature*. New York: Frederick A. Praeger, 1968.
- Forrester, Jay W., "Counterintuitive Behavior of Social Systems." *Technology Review*, Vol. 73, No. 3 (January, 1971), pp. 53-68.
- Glass, Bently, "Science: Endless Horizons or Golden Age." *Science*, Vol. 171, No. 5966 (January 8, 1971), pp. 23-30.
- Hilton, Alice Mary, *The Evolving Society*. New York: The Institute for Cybercultural Research, 1966.
- Hoelcher, H. E., "Technology and Social Change." *Science*, Vol. 166 (October 3, 1969), pp. 68-72.
- Hopkins, Frank Snowden, "The Rise of Technological Man." *The Futurist*, Vol. 4, No. 1 (February, 1970), pp. 12-13.
- Illich, Ivan, "The Alternative to Schooling." *Saturday Review*, (June 19, 1971), pp. 44-48 & 59-60.
- Koestler, Arthur, *Act of Creation*. New York: The Macmillan Company, 1964.
- Koestler, Arthur, *The Ghost in the Machine*. New York: The Macmillan Company, 1967.
- Kuhn, James W., "Would Horatio Alger Need a Degree." *Saturday Review*, (September 19, 1970), pp. 54-55 & 64.

- Landers, Richard R., *Man's Place in the Dybosphere*. Englewood Cliffs: Prentice-Hall, Inc., 1966.
- McHale, John, *The Future of the Future*. New York: George Braziller, 1969.
- Marmor, Judd, "Psychiatry and the Survival of Man." *Saturday Review*, (May 22, 1971).
- Mead, Margaret (ed.), *Cultural Patterns and Technical Change*. Paris: UNESCO, 1955.
- Mesthene, Emmanuel G., *Technological Change*. New York: New American Library, 1970.
- Mumford, Lewis, *The Myth of the Machine*. New York: Harcourt, Brace, Jovanovich, Inc., 1970.
- Parker, J. Cecil, and Louis J. Rubin, *Process as Content: Curriculum Design and the Application of Knowledge*. Chicago: Rand McNally, 1966.
- Richta, Radovan, *Civilization at the Crossroads: Social and Human Implications of the Scientific and Technological Revolution*. Czechoslovakia: International Arts and Sciences Press, Inc., 1969.
- Rosenblith, Walter A., "Requiem for an Ivory Tower." *Technology Review*, Vol. 73, No. 7 (May, 1971), p. 61.
- Roszak, Theodore, *The Making of a Counter Culture: Reflections on the Technocratic Society and Its Youthful Opposition*. Garden City: Doubleday and Company, 1969.
- Schmandt, Juergen, "Technology and Education," *Issues in American Education*, Kroll, Arthur M. (ed.). New York: Oxford University Press, 1970, pp. 76-96.
- Schon, Donald A., "Implementing Programs of Social and Technological Change." *Technology Review*, Vol. 73, No. 4 (February, 1971), pp. 47-51.
- Skolimowski, Henryk, *Proceedings of the American Industrial Arts Association*, "Extension of Technology from Utopia to Reality." Washington, DC: American Industrial Arts Association (August, 1970), pp. 24-36.
- Spicer, Edward H. (ed.), *Human Problems in Technological Change*. Russell Sage Foundation, 1952.
- Szent-Gyorgyi, Albert, "The Third Environment." *Saturday Review*, (May 2, 1970), p. 63.
- Thurow, Lester C., "Research, Technical Progress and Economic Growth." *Technology Review*, Vol. 73, No. 5 (March, 1971), pp. 45-52.
- Tobin, Richard L., "News and the Functional Illiterate." *Saturday Review*, (June 13, 1970), pp. 51-52.
- Toffler, Alvin, *Future Shock*. New York: Random House, 1970.
- Tribus, Myron, "Education for Innovation." *Engineering Education*, Vol. 61, No. 5 (February, 1971), pp. 421-423.
- Wallia, C. S. (ed.), *Toward Century 21: Technology, Society, and Human Values*. New York: Basic Books, Inc., 1970.
- Wilson, Jan H., "How Our Values Are Changing." *The Futurist*, Vol. 4, No. 1 (February, 1970), pp. 5-9.

## CHAPTER THIRTEEN

# Industrial Arts: The Study of Industrial Technology

*Donald F. Hackett  
Chairman, Industrial Arts  
Georgia Southern College*

It may be argued that tool making and tool using started the long process of evolution that resulted in Homo Sapiens, modern man, and civilization as we know it today. Washburn explains this concept when he states that:

. . . it appears that man-ape creatures able to run but not yet walk on two legs, and with brains no larger than those of apes now living—had already learned to make and use tools. It follows that the structure of modern man must be the result of the change in terms of natural selection that came with the tool-using way of life . . . . Tools, hunting, fire, complex social life, speech, the human way and the brain evolved together to produce ancient man of the genus Homo about a half a million years ago. (p. 3)

It would seem, then, that when man-ape creatures stood up so they could better use tools, they laid the foundation for the evolution of both modern man and technology. Man is, therefore, a producer of technology and a product of technology.

Technology has been the dominant influence in the process of man civilizing himself. It continues to dominate our lives. Our culture is distinctly technological. Technology is an integral, central, part thereof.

The term "technology" comes from two Greek words meaning the study of art or skill. The dictionary defines it is a study of the arts of industry. Dewhurst (p. 834) states that technology is the "accumulated knowledges, techniques, and skills, and their application in creating useful goods and services . . . Technology, in fact, can be thought of as the primary resource; without it all other resources would be economically nonexistent." Kranzburg (pp. 4-6) states that ". . . technology is man's efforts to cope with his physical environment . . . It deals with human work, with man's attempts to satisfy his wants by human action on physical objects."

Technology, for educational purposes then, is a study of man using mind, materials and energies to create his own environment by controlling and using nature. It includes agriculture, manufacturing, medicine, services, communication, construction, transportation, mining, management, homemaking and every other way in which man satisfies his material needs and wants.

Education in the United States purports to transmit our culture to the young. Since our culture is distinctly technological, it follows that there should be a technological element in education. An examination of most school objectives reveals some recognition of this responsibility. However, an examination of the curriculum reveals an almost total neglect of the very essence of both man and culture—technology and the consequent world of work.

This neglect of technology is not too difficult to understand. Formal education was introduced after man found he had leisure time; when all of his waking hours need not be occupied in searching for or producing food. The prime function of this education was to prepare one for a life of contemplation, leisure, and luxury, the antithesis of that which the applications of technology involved. The 3 R's, education, leisure, respect, wealth, all become interwoven in the minds of the masses. This cause-effect relationship included no concern for technology because technology had always been with us and technological changes occurred so slowly their impact was barely discernible. Consequently, the school's concern became that of providing a study of the humanities and sciences for a select few.

When manual training was introduced, it was advocated as a form of trade training. Later, its general education values were stressed. Industrial Arts continued the emphasis on the general education values of a study of industry—usually trades or crafts. Vocational Industrial Education was introduced in an attempt to meet the demands of the labor market and the needs of a growing school population. Both programs had real values for some students at the time of their introduction, but both failed to keep up with and reflect the changes produced by the very discipline with which they purported to deal—technology.

Technology is a body of knowledge, a discipline, that may be organized for study. The purposes for the study may be different and the emphasis may be different for different groups of students, but all students today need some orientation to technology. This orientation must, however, reflect the technology of the twentieth century. According to Drucker (p. 39), this technology:

. . . embraces and feeds off the entire array of human knowledges, the physical sciences as well as the humanities . . . . Equally important and equally new is the fact that every one of the new emerging industries is squarely based on knowledge. Not a single one is based on experience . . . they will employ predominately knowledge workers rather than manual workers . . . . The productivity of the worker will depend on his ability to put to work concepts, ideas, theories—that is, things learned in school—rather than skills acquired through experience.

The citizen of tomorrow, the student of today, needs a school curriculum that will help him develop to his maximum human potential. A curriculum based on facts and a narrow study of a few disciplines can hardly accomplish this end. Education, then, should become the total integration of all subject matter—of all knowledge—directed toward the goals of developing the basic skills which make man human. Some of these basic skills or kinds of human behavior are:

Reading	Interpreting	Evaluating
Writing	Organizing	Participating
Speaking	Analyzing	Studying
Computing	Planning	Cooperating
Listening	Judging	Creating

These basic skills are perpetually salable. They are essential for successful living in our culture today and tomorrow. They

are not the exclusive property of or peculiar to any single subject now a part of the school curriculum. They may and should be developed in every school experience provided. Subject matter, then, becomes the vehicle through which these important outcomes are produced. Curriculums can, therefore, be developed to meet the interests as well as the needs of students.

Curriculums containing 20th century technology should be organized so as to contribute to the development of the basic skills listed above and provide for the development of others such as:

Designing	Testing	Sketching
Inventing	Operating	Cutting
Depicting	Constructing	Shaping
Experimenting	Assembling	Forming
Developing	Disassembling	Finishing
Diagnosing	Maintaining	Measuring
Managing	Installing	Controlling
Procuring	Adjusting	Scheduling

These competencies are identifiable with what is commonly known as industrial technology. The list is not exhaustive; there are others. Furthermore, there are similar and also different competencies in the other divisions of technology: agriculture, medicine, etc. The point here is that these are distinctly human aptitudes which education can and should develop. Units of instruction, even courses, could be established in each. Traditional subject matter and knowledge would then serve only an ancillary purpose in the development of these aptitudes. Some traditional subjects would probably completely disappear from the school curriculum. In this context we would have teachers of designing, inventing, depicting, experimenting, etc., rather than teachers of history, mathematics, woodworking, drafting and the like.

This concept of education is probably too radical to find acceptance by many. However, the idea that school programs can and should be designed to develop human potential for the world outside the school should be readily acceptable. Several approaches and methods suggested for industrial arts in the past decade have reflected much of the above rationale. Courses in Research and Development, Design, Communications, Manufacturing and the like are embodiments of this point of view.

Technology and the associated world of work should be a part of education at every level. In the elementary grades, it should be an element of an integrated whole that deals with man providing for his food, clothing, shelter, transportation, communication and other material and environmental needs. Constructional activities should be employed to enrich the common learnings program.

Since subject matter courses and departmentalization will continue to characterize education for some time, industrial arts, as a subject, should begin at the junior high school level. Here the students should be introduced to a broad study of industrial technology for the following purposes:

1. To develop insights and understanding of industry and its technology in our culture.
2. To discover and develop interests and capabilities in technical and industrial fields.
3. To develop the ability to safely use tools, materials and processes of industry to solve technical problems.

Ideally this study should be provided on each grade level of the junior high school. Courses should be designed to develop the basic skills as well as concepts concerning man's achievements with mind, materials and energies in areas of technology such as manufacturing, communications, construction and transportation. In addition to technical, consumer, social-cultural and recreational content, each course should provide an orientation to the principal occupations involved. Students should be involved in activities that help them to understand the opportunities and working conditions in these areas and that assist them in relating their own assets and liabilities, interests and aptitudes, to the requirements therein. Simulated work experiences provided in this way may be superior to the limited experiences actual on-the-job involvement permits. Conceptual models of the four areas are presented as Figures 2, 3, 4 and 5 and appear at the end of the chapter.

Courses may be organized to fit a quarter, semester or academic year plan of scheduling. During the transition period General Industrial Arts courses should be reorganized to include these studies rather than woods, drafting, metals, electricity, etc., as has been the practice. Figure 1 depicts industrial arts in grades 7-12 and reflects this transition or evolution.

SPECIAL EDUCATION	INDUSTRIAL ARTS - A STUDY OF INDUSTRIAL TECHNOLOGY		
<b>TERMINAL</b> Effective Living	<b>PRE VOCATIONAL</b> Tradesmen, Technicians and Technologists	<b>COLLEGE PREPARATORY</b> Engineers, Scientists, Industrial Teachers and Technologists	<b>GRADE</b>
<b>WORK EXPERIENCE</b>	<u>Level III</u> <b>CLUSTERS</b> TRANSPORTATION MANUFACTURING CONSTRUCTION COMMUNICATIONS SERVICES	<b>RESEARCH AND DEVELOPMENT</b>	12
<b>OCCUPATIONAL INFORMATION</b>		<b>ENGINEERING DRAFTING AND DESCRIPTIVE GEOMETRY</b> Product, Network, Systems and Facility Design	11
<b>CONSTRUCTIONAL ACTIVITIES</b>	<u>Level II</u> <b>GENERAL INDUSTRIAL TECHNOLOGY</b>	<b>AMERICAN INDUSTRIES</b> Man, Technology, Society	10
<b>CONSUMER KNOWLEDGE</b>		TRANSPORTATION TECHNOLOGY MANUFACTURING TECHNOLOGY CONSTRUCTION TECHNOLOGY COMMUNICATIONS TECHNOLOGY	
<b>HOME MAINTENANCE</b>			
<b>HEALTH &amp; SAFETY</b>			
<b>HOBBIES</b>	<b>GENERAL INDUSTRIAL ARTS</b> Industrial Organization and Management, Product Planning, Design, Drafting, Woods, Metals, Electricity, Mechanics, Graphic Arts, Production Processes.	<u>Level I</u> <b>GENERAL INDUSTRIAL ARTS</b>	
<b>CRAFTS</b>		<b>TRANSPORTATION</b>	9
		<b>MANUFACTURING</b>	8
		<b>CONSTRUCTION</b>	7
	<b>COMMUNICATIONS</b>		
	<b>ELEMENTARY EDUCATION</b> Informal Constructional Activities and Study of the "World of Work" to Enrich the Common Learnings Program		6   K

Figure 1. Industrial Arts in Perspective.

Career development is an important function of education and junior high school industrial arts, as well as every other subject, has an important role to play. The teacher and the school counselor should work together to help young people begin to understand themselves and the opportunities and requirements of the world of work.

There is no justification, however, for young people being pushed into making a specific occupational choice. At this stage of their development they should begin to identify themselves as fitting, more or less, into one or more of the following categories of occupations and world of work divisions:

<i>Occupations</i>	<i>World of Work Divisions</i>
Creators (inventors)	Agriculture, Forestry, Fisheries
Organizers (leaders)	Mining
Operators (followers)	Construction
Maintainers	Manufacturing
	Transportation
People Oriented	Communications
Thing Oriented	Trade, Wholesale-Retail
Data Oriented	Finance, Insurance, Real Estate
	Personal Services
	Government

As the students move into the senior high school years, teachers and counselors should help them further refine their self-understanding in terms of education and the world of work. Industrial Arts should provide an opportunity for those who have an interest in industrial technology to continue this process of refinement. This means, then, that a variety of developmental activities should be provided in industrial arts and in the other areas of the school program.

Students who identify with leadership and invention in industrial technology and who possess the required aptitudes should be challenged along these lines. Industrial Arts courses dealing with problems in product, facility, network and systems planning, design, management, research and development should be offered for this kind of student. Courses in English, mathematics, science, etc., should also relate to these students' needs, interests and activities.

In schools where students are grouped in "college preparatory" classes, provision should also be made for the college bound technology student. The accompanying chart illustrates this organization. American Industries is a non-laboratory course in which the origins and development, processes, products and problems of industry are studied. Students are involved in readings, discussions, investigations of technological problems, reporting, demonstrating and otherwise studying industrial tech-

nology. The Engineering Drafting course is planning and design oriented. The techniques of drafting are taught as they apply to the solutions of a wide range of systems design and management problems. The Research and Development course is an "honors" course for those students who can propose an invention or innovation requiring the use of tools and materials in its development. In any school, these college bound students may be dealt with on an individual basis, either in or outside of any regularly scheduled class.

The students who exhibit operator (follower) and maintainer category qualities should similarly be provided for. In addition to assisting these young people in further identifying the area of industrial technology that interests them most, they should be aided in developing to the limit of their abilities the aptitudes that will permit them to enter further education and the world of work with the highest probabilities of success.

For some students this will, of necessity, be short term, specialized, intensive training. These are students with handicaps of one sort or another who will leave school early or be incapable of benefitting from the regular school program. These students are already being identified in the elementary grades. The chart reflects an ungraded provision for their needs under the heading "Special Education". The representative information topics and activities identified are not industrial arts offerings, but may be taught or supervised by an appropriately prepared industrial arts teacher.

The majority of students who are interested in industrial technology will best be served by a study that continues to develop the basic skills identified earlier. With the orientation and exploration provided by the aforementioned junior high school program, these students should be guided into a second level, one period per day, study in one or more of the areas of manufacturing, communication, construction and transportation. These courses should provide a study in greater depth than the junior high school level in the systems and applications concepts shown on the conceptual models (Figures 2-5). Greater emphasis should be placed on the technical and occupational content.

These courses require that senior high school laboratories be designed to provide for this kind of instruction. A manufac-

turing laboratory should include tools, equipment and materials for planning, processing, testing and research with a wide range of materials. Woods, metals and plastics should, of course, be provided, but provision should also be made for other materials including those of the textiles and the chemical process industries. Furthermore a large clear area should be provided in which plant planning and layout studies may be tested and applied. This feature requires a highly flexible power and service supply system and a storeroom for the machines, conveyors, etc., that will be arranged according to the plan.

The construction laboratory should be characterized by a large open area and several large storerooms. Equipment should be portable. The laboratory should open onto a large outdoor site for certain site development and construction activities. It should provide equipment for carpentry, cabinetmaking, plumbing, electricity, masonry and the like. With careful planning, manufacturing and construction courses can be provided in the same laboratory.

The communications laboratory should provide for a study of the "systems" and "applications" shown on the conceptual model in Figure 4. Similarly, the transportation laboratory should provide for the "systems" and "applications" shown on Figure 5.

Each laboratory should provide seating and a full range of audio-visual materials for class instruction. Also, provision for independent study and research should be made including a small library of printed and programmed instructional materials.

The introduction of this program does not depend on the availability of new facilities as described above. Existing laboratories such as woods, metals, drafting, electronics and automobiles may be used. The important element is the course content and activities provided. As experience and opportunity permit, these facilities may be renovated and new facilities built to better serve these new courses.

Students completing one unit of this second level study of industrial technology may choose to study in the other areas during their remaining years in school. Others will wish to continue their study and seek a degree of specialization in that which the second level helped them identify.

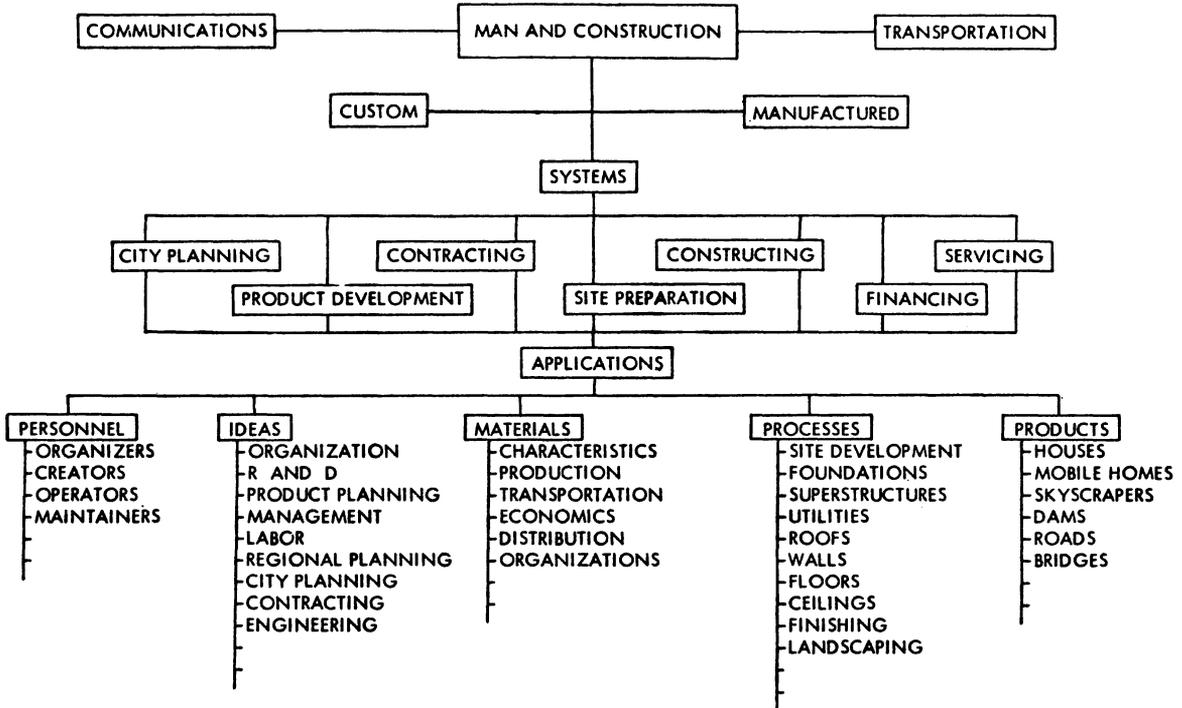


Figure 2. Manufacturing Conceptual Model.

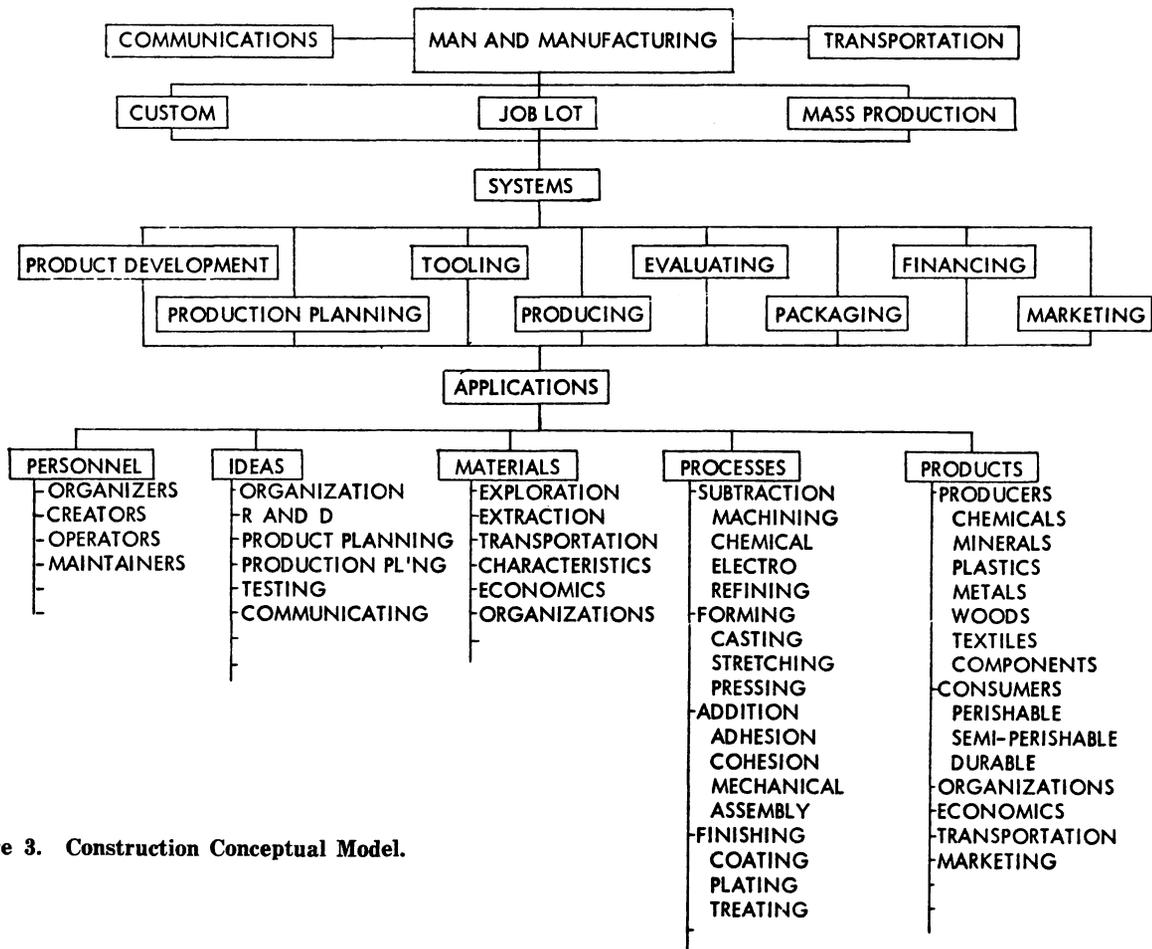


Figure 3. Construction Conceptual Model.

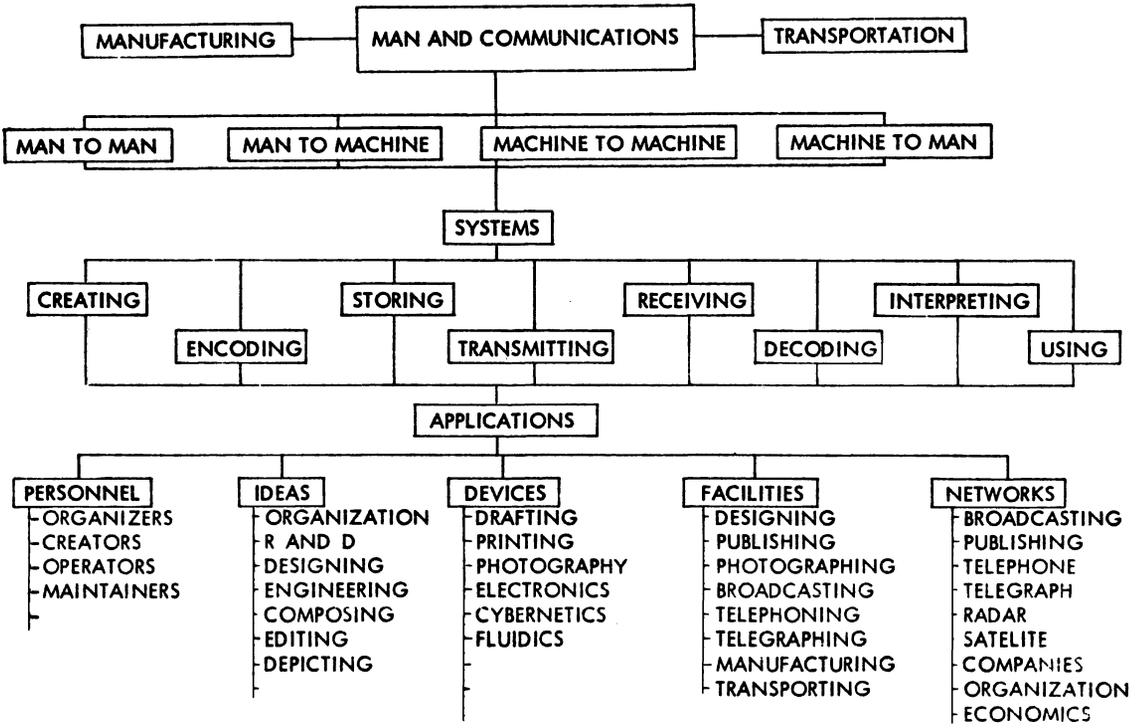


Figure 4. Communications Conceptual Model.

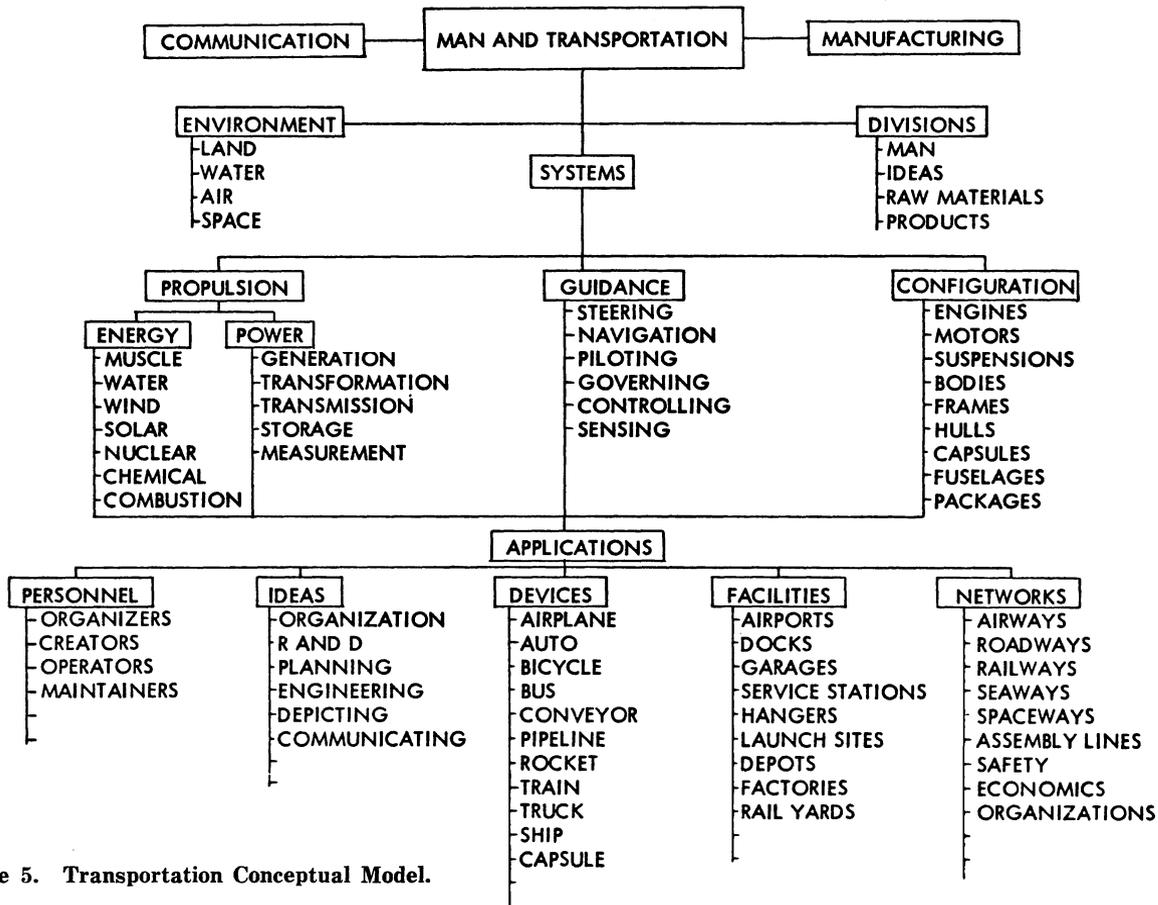


Figure 5. Transportation Conceptual Model.

Those students who wish to begin specializing should have the opportunity to study in still greater depth clusters of "applications" indicated on the conceptual models. This study should be offered on a two-period-per-day basis. Clusters should be provided in manufacturing, communications, construction, transportation and services. The same facilities as used for the second level courses may serve this third level.

The manufacturing cluster should permit a student to specialize in the areas of his interest and at the level his aptitudes permit. Thus, some students may concentrate in organization and management and/or product design and development; others might concentrate in machine operation, sheetmetal layout and development, welding, research and development and the like. Technical, occupational and career study should receive continuing emphasis.

The communications cluster should permit concentration of study in the "applications" shown. The construction cluster and the transportation cluster should similarly permit in-depth study and/or skill development in the chosen area. The services cluster should provide a study of the care and maintenance of a wide variety of home and industrial appliances and mechanisms. Occupational and career study should develop understandings of the opportunities and requirements of the career including establishing a private business.

Teachers capable of handling these clusters are not generally available. However, both in-service and pre-service teacher education programs can produce individuals who could provide instruction and guidance at the level these students might benefit from. Work experience in several areas of a cluster may be desirable, but seems to be an impractical, inefficient way to prepare the kind of teacher needed. The training program for the teachers should develop sufficient skill that the operations may be taught at a level suitable for the students involved. During the transition period, team teaching and resource persons should be used extensively.

Students who complete a cluster may choose to study a second cluster in their last year in school. Others may choose to enter a co-op work experience program conducted by a qualified coordinator.

Upon graduation from high school some of the students will enter the labor force; some will enter vocational-technical schools, colleges and universities to obtain specialized preparation or professional degrees in engineering, industrial management, marketing, science, economics, teaching and the like. Ideally the college program will continue the process of aptitude development and world of work orientation that was begun in the elementary grades.

Experience has taught that success in college, and in life, is not determined by the track or sequence of courses one has studied in school, but by the extent to which he has developed the basic skills of human behavior identified earlier and how well he can apply them in educational or real-life situations. The program of industrial arts described here is intended to provide for the development of these basic skills and to acquaint the student with several areas of our technological culture in which they may be applied.

### BIBLIOGRAPHY

- Dewhurst, J. F., and others, *America's Needs and Resources*. New York: The Twentieth Century Fund, 1955.
- Drucker, Peter, *The Age of Discontinuity*. New York: Harper and Row, Publishers, 1969.
- Kranzburg, M., *Technology in Western Civilization*. New York: Oxford University Press, 1967, Vol. 1.
- Olson, D. W., *Industrial Arts and Technology*. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1963.
- Washburn, S. L., *Tools and Human Evolution*. *Scientific American*, Volume 203, No. 3., September, 1960.

# An Upward Extension of the Industrial Arts Curriculum Project Junior High School Program

*Donald G. Lux and Willis E. Ray  
Professors of Industrial Technology  
The Ohio State University*

Extensive materials are available which relate the authors' rationale for and program of junior high school industrial arts. Principally these include the document *A Rationale and Structure for Industrial Arts Subject Matter* (IACP, 1966), the integrated instructional systems titled *The World of Construction* (IACP, 1970) and *The World of Manufacturing* (IACP, 1971), and the *Final Report* (IACP, 1971) of the Industrial Arts Curriculum Project. This chapter is based upon these materials, plus an unpublished presentation for Phase II of the Texas Industrial Arts Curriculum Study (Lux, 1970) and an article in the journal *Theory Into Practice* (Lux and Ray, 1970). This chapter is based on these writings, but here the major concern is with the nature and purpose of a logically defensible upper-secondary school program of studies in industrial arts. The chapter is organized according to an outline suggested by the editor of this yearbook. It begins with philosophy or speculations about the nature of the body of knowledge from which industrial arts subject matter

may be drawn and with regard to the objectives to be served. It continues with psychological considerations and program details. It concludes with behavioral outcomes to be sought.

### PROGRAM RATIONALE

A working philosophy for industrial arts might appropriately begin with a concern for the nature of knowledge as a context. Only then can a meaningful sub-element of knowledge, such as industrial arts subject matter, be discussed. This point of view rests on the assumptions that: (1) to provide for the most effective and efficient transmission of knowledge, the educator should codify and structure disciplined bodies of knowledge and (2) the structure of a body of knowledge can be developed before the total curriculum is designed.

Aristotle, the first great systematizer, named three classes of knowledge: (1) the theoretical disciplines, (2) the practical disciplines, and (3) the productive disciplines. The theoretical disciplines were mathematics, natural sciences, and metaphysics. The practical disciplines included ethics, politics, and human conduct. The productive disciplines included the fine arts, the applied arts, and engineering. (McKeon, 1947)

Knowledge gradually came to be perceived as restricted to science and mathematics (Aristotle's theoretical disciplines). In the nineteenth century Auguste Comte, father of modern positivism, proposed a classification scheme that was widely used in place of Aristotle's. His positive hierarchy of the sciences started with mathematics as the natural logic governing the study of all subject matter. After mathematics came, in order, physics, chemistry, biology, and the social sciences. (Cassirer, 1950) This organization has had a tremendous influence on the teaching of science at both the collegiate and high school levels.

New classifications of knowledge continue to be proposed. Hanna (1961) points out the remarkable similarity of present-day classifications of knowledge in Western culture to the ancient Chinese system that divided knowledge into three categories—*man-to-thing*, *man-to-man*, and *man-to-spirit*. These correspond to our three classifications—natural sciences, social sciences, and humanities. Hanna accepts the essentials of the Aristotelian classification, but his system does not account for the applied arts.

Phenix (1964a) recognizes six realms of meaning that emerge from the analysis of the possible distinctive modes of human understanding: (1) symbolics, (2) empirics, (3) esthetics, (4) synnoetics, (5) ethics, and (6) synoptics. The *symbolics* include ordinary language, mathematics, and nondiscursive symbolic forms. The *empirics* include the physical sciences, the life sciences, psychology, and the social sciences. The *esthetics* cover music, visual arts, arts of movement, and literature. The *synnoetics* encompass philosophy, psychology, literature, and religion in their existential aspects. The *ethics* include various special areas of ethical and moral concern. The *synoptics* include history, religion, and philosophy. Phenix, too, is Aristotelian in his classification, and omits the applied arts and engineering.

### Praxiology—The Science of Efficient Action

In outlining four principal classes of "speculation," E. Macchia gives explicit recognition to praxiology. The classes of speculation obviously relate to the subsequent classes or categories of systematized knowledge. These types of speculation may be about *form, events, values, and practices*. Therefore, the scholar and researcher deal with formal theory, event theory, valuational theory, and praxiological theory. "Formal theory is speculation with respect to structures . . . . Event theory is speculation with respect to occurrences . . . . Valuational theory is speculation as to worthwhileness . . . . Praxiological theory is speculation about appropriate means to attain what is taken to be valuable". (E. Macchia, 1965, pp. 4-5)

From the above four classes of theory, we propose four domains of man's knowledge: (1) descriptive knowledge, (2) prescriptive knowledge, (3) praxiological knowledge, and (4) formal knowledge.

The term used to identify the first domain, *descriptive knowledge*, is *sciences*. The sciences seek and establish facts about phenomena and events and describe their interrelation. Major divisions of the sciences include the physical, biological, and social or "hominological" sciences. (E. Macchia and G. Macchia, 1962, p. 3)

The second domain, *prescriptive knowledge*, includes the *fine arts* and the *humanities* which seek to provide a system (or

systems) of values—judgments as to whether phenomena or events are true and/or good and/or beautiful. Literature, philosophy, and the non-performing dimensions of music and art are the important divisions of prescriptive knowledge in higher education.

The third domain is the *knowledge of practice or praxiology*—ways of doing which bring about through efficient action what is valued. This domain is represented in higher education by the professional schools and departments. Among them would be medicine, journalism, law, marketing, education, dentistry, dairy technology, and pharmacy. These applied or derived fields of knowledge draw upon the formal, descriptive, and prescriptive domains as *necessary* but *insufficient* background for full status in the practicing profession. Practice itself is also necessary for proper training but, even with formal, descriptive, and prescriptive knowledge, it is not sufficient. These disciplines demand a clinical or professional body of subject matter.

The fourth domain is *formal knowledge*. The disciplines with formal knowledge serve as tools for ordering all knowledge and therefore could be considered as the form or arrangement (syntactics) of the three categories presented above. Mathematics and logic are examples of such fundamental disciplines.

The sciences (descriptive knowledge), the fine arts and humanities (prescriptive knowledge), and mathematics (formal knowledge) have had the longest history and the greatest acceptance in education. Even a cursory examination of school curricula, however, reveals a lack of comprehensiveness of approach even in these three domains. For example, psychology, philosophy, and logic are not visible in the elementary and secondary school curriculum.

Praxiology has been given less recognition in the formal school than have the descriptive and formal domains. Historically, apprenticeship in the trades and crafts (education of an informal or nonschool type) antedated the formal school. Several occupation- or practice-oriented formal school subjects do offer a study of selected practical arts such as agriculture, home economics, business and office occupations, distributive education, trade and industrial education, and industrial arts. However, because of their recent arrival on the school scene and their rapidly expanding and changing body of knowledge, they rarely

have been organized to attain the goal of a systematic coverage of man's knowledge of practice. Rather, they have been treated primarily as selected practical experiences together with related supporting principles of the formal, descriptive, and prescriptive domains of knowledge. Almost no attempt has been made to systematize the comprehensive body of *knowledge of practice* or *efficient action* in these fields. In spite of this, they have achieved a degree of success in the school curriculum, and in many communities one or more of them are required of all public school pupils.

A review of recent statements regarding the content appropriate for school education will substantiate the above claims. Bellack reviews the stated positions of four leading educational theorists, each representing a different philosophical and educational orientation. He concludes: ". . . there is substantial agreement regarding the disciplines and broad areas to be included in the program for all students: the natural sciences, mathematics, social sciences, and humanities". (1961, p. 47) Note that praxiological considerations are omitted.

Bellack (1964) wrote that there is universal agreement that knowledge derived from organized inquiry is the stock-in-trade of the school. But he suggests that there is also general agreement that the school's responsibility extends beyond the organized realms of inquiry and learning. The school must meet the multitude of needs created by the society and culture. He recommends that study "in the round" is appropriate for the school and that the teaching of specific cognate disciplines (e.g., social sciences) and broad areas of knowledge (sciences on the one hand, and humanities on the other) should be related to human problems and their solutions. Although implied by the phrase "human problems and their solutions," no explicit support is given to the study of knowledge of practice.

Phenix, in his *Realms of Meaning: A Philosophy of the Curriculum for General Education*, claims that:

. . . the curriculum should at least provide for learnings in all six of the realms of meaning: symbolics, empirics, esthetics, synnoetics, ethics, and synoptics. Without these a person cannot realize his essential humanness. If any one of the six is missing, the person lacks a basic ingredient in experience. They are to the fulfillment of human meanings something like what basic nutrients are to the health of any organism. Each makes possible

a particular mode of functioning without which the person cannot live according to his own true nature. (Phenix, 1964a, p. 270)

It should be noted that Phenix indicates that these areas of knowledge are *minimal* for the school program. In the same book he discusses the differences between general and specialized studies and between fundamental and derivative or applied fields of learning. Phenix concludes that general education develops the person in his essential humanity, while specialized education provides for particular competencies for purposes other than the development of a person as a person. "The significant distinction is between studies intended to develop *kinds* of understanding (not *particular* understandings) that *everybody* needs simply because he is human, and studies intended to develop kinds of understanding that only some people need in order to fulfill certain particular individual or social needs". (Phenix, 1964a, p. 272)

With regard to the distinction between the fundamental and the derivative or applied fields of learning, Phenix writes:

The term "fundamental" refers to fields that are concerned with the deliberate and direct pursuit of one of the six possible kinds of meaning . . . Derivative or applied fields, on the other hand, result from the utilization of meanings from the fundamental disciplines in the solution of problems arising out of biological and social exigencies. Fundamental studies focus on the pure types of meaning, having regard for their distinctive forms. Derivative studies grow out of practical considerations, and workers in them seek solution to problems without regard to purity of logical type. (Phenix, 1964a, p. 273)

That such organized bodies of practical knowledge exist is indicated by Phenix:

Some disciplines are primarily devoted to understanding, apart from the service of practical needs. Others are concerned mainly with application. Physics is an example of the former and engineering of the latter. Economics is a purely cognitive discipline, while marketing and insurance are practical or applied disciplines. History comprises pure knowledge; law deals with practical matters. Knowledge in the applied disciplines has structures, just as in the case of the theoretical disciplines. The practitioners of the applied disciplines also form identifiable communities of specialists. Similarly, the practical disciplines owe their existence to the fact that productive ways of organizing knowledge have been discovered. In these cases, however, the productivity is measured by success in dealing with the problems of practice. (Phenix, 1964b, pp. 50-51)

According to Phenix, “. . . *all* curriculum content should be drawn from the disciplines . . . *only* knowledge contained in the disciplines is appropriate to the curriculum”. (Phenix, 1962, p. 57) Since there are practical disciplines, it would follow that the school could include elements of such study in the curriculum.

Broudy, Smith, and Burnett (1964) propose a design for a common curriculum for grades seven through twelve. They suggest five major categories: (1) symbolic skills in language and mathematics; (2) basic concepts from general science, biology, chemistry, and physics; (3) developmental studies in three sets—universe and cosmos, human institutions, and culture; (4) value exemplars from art, literature, philosophy, and religion; and (5) social or moral problems sampled in the last years of the high school.

Each category suggests subject matter fields and implies the disciplines from which they are drawn. However, the category of developmental studies may need further elaboration. The authors state:

The basic sciences serve to organize and classify human knowledge as it now exists. When so taught and so learned, they can be used as cognitive maps to structure experience with order and some precision. What these sciences do not reveal is how our universe, our institutions and our culture, that is, our technologies, our ideologies, our arts and our sciences came to be what they now are. Nor do they tell us what we need to know about those disciplines that are devoted to anticipating the needs of our society or to meeting its current problems; yet part of the cultural capital is that great stock of methods which have been developed for accumulating, storing, elaborating and disseminating the culture. Finally, the basic sciences give only an inkling of man's efforts to make sense of life as a whole and to find a meaningful goal for it. The role of science in the human quest is a tribute to man's highest powers, but it does not justify the quest itself. (Broudy et al., 1964, p. 201)

Within the developmental study sets, certain typical practical arts subjects such as industrial arts are given a prominent place, but with the admonition that such subjects, as presently taught, must undergo radical revision to serve the general education need. Of considerable importance would be the study of the evolution of industrial technology and of the major industrial processes with which man reshapes natural resources for his material needs.

The most widely held view of practice is that man does what has been shown to him by an experienced person and, at most, applies some of the principles of theoretical knowledge in practical situations. By implication, the elements of practice cannot be ordered, taught and studied. This view of the theory-practice dichotomy would support the teaching of "basic" or "fundamental" knowledge of the formal, descriptive, and prescriptive domains together with the planned application of these "fundamental" principles in practical experience. That such a position is memorialized by our continued reliance on internship and apprenticeship has been pointed out by Schwab (1964). For example, colleges of education rely heavily on "practice" teaching. In fact, student teaching is consistently rated by education students as the most significant learning experience in professional education. "Methods" courses attempt to provide the "knowledge of practice."

The word "praxiology" comes from the Greek *praxis* meaning *to do*, or the practice of an art, science, or technical occupation. The suffix "ology," denoting a branch of study or knowledge, completes the full meaning: the knowledge (principles) of man's practices.

Kotarbinski defines praxiology as "the science of efficient action." He writes:

. . . the tasks of praxiology are to formulate and to prove recommendations concerning what must be done: what it is advisable to do under definite circumstances in order to attain the intended results in the most efficient way . . . In our endeavor to set apart praxiological theorems we shall have, first of all, to distinguish the essential theses of that discipline, as opposed to its auxiliary and secondary sentences. Now these essential theses are certain practical directives, that is, directives recommending as appropriate means those which lead to definite results. (1962, p. 211)

Praxiology represents more than the sum of the parts (formal, descriptive, and prescriptive knowledge). He continues: The essential point is that the practical disciplines cannot remain satisfied with borrowing from strictly theoretical disciplines their theorems on relationships between events, but must themselves search for those relationships on which their own recommendations are to be based. (1962, pp. 219-20)

For example, a knowledge of practice may be codified that expands upon the laws and principles of, for example, physics or

chemistry, as they relate to industrial activities. In support of this contention, one writer notes: Technologies founded on an application of science may form a scientific system of their own. Electrotechnics and the theory of aerodynamics are examples of *systematic technology* which can be cultivated in the same way as *pure science*. (Polanyi, 1964, p. 179)

The case made herein for the recognition of praxiology does not imply any de-emphasis of the descriptive, prescriptive, and formal domains of knowledge. These form, however, only a portion of the base upon which the praxiological studies rest, for the element of practical experience is critical. It should be pointed out that a knowledge of practice does not reduce the need either for knowledge or for practice. All three ingredients—(1) *knowledge* (of the formal, descriptive, and prescriptive domains), (2) *knowledge (principles) of practice* (knowledge of the praxiological domain), and (3) *practice*—are necessary for a complete educational program.

### **Praxiology and Technology**

Praxiology may be equated with technology when technology is defined as the knowledge or the study of efficient technique or practice. For popular discourse, technology now is adopted to identify what has been described, to this point, as the praxiological domain of man's intellectual and cultural heritage. Technology (praxiology) is a vast body of knowledge. There is a knowledge of techniques that relates to sex (and this technology is expected to solve one of man's most serious problems—overpopulation), law, home management, and all other areas of man's functioning. Surely such a broad-ranging subject is not the exclusive domain of the industrial arts teacher. It would seem far more realistic for all disciplines to embrace a responsibility for teaching allied technology. For example, the mathematics teacher could teach computer technology and measuring techniques along with number concepts and theories. The science teacher could teach sanitation and sex techniques along with generalized scientific principles and theories. The technology of technical or journalistic writing could be the responsibility of the English teacher. This is not to say that these teachers should teach only techniques, but logic would also dictate that they should refrain from teaching only theoretical abstractions.

Industrial arts teachers should continue to reinforce mathematical, scientific, and language principles as they focus on technology, but *they should focus on technology rather than on other disciplines*. More particularly, they should focus on industrial technology, because that is what they know most about and are best able and equipped to teach. By the same token, the science teacher is best equipped to focus on science, but he is artificially emasculating his subject matter if he ignores his many opportunities to illustrate and reinforce it by teaching about science-technology relationships.

Industrial technology, just one element of the total field of technology, is that technology which has to do with the production, consumption, operation, and servicing of material goods. Industrial technology is the knowledge resource of industrial arts. Again, the industrial arts teacher should reinforce other learnings—such as business practices, mathematics, communications, and science—but his unique contribution to the education of youth lies in his specialized knowledge of and ability to teach industrial technology.

### A MATRIX OF INDUSTRIAL TECHNOLOGY

In order to conceptualize the body of knowledge contained in industrial technology, a matrix approach has been devised. Figure 1 shows the basic scheme: a first-order matrix of industrial technology. This scheme provides a unique way of looking at the multi-dimensional elements of the body of knowledge. In the three-dimensional matrix approach, increasing levels of specificity may be added onto one or any combination of the axes. If all three axes were developed, it would seem theoretically possible to select an almost infinite number of combinations from the matrix. The obvious advantage of this approach is the movement from general to the specific.

#### The First Order Matrix

Figure 1 indicates that industrial management practices, combined with industrial production practices, yield industrial material goods and affect humans and materials.

Subsequent figures separately categorize those practices which primarily affect humans and those which primarily affect

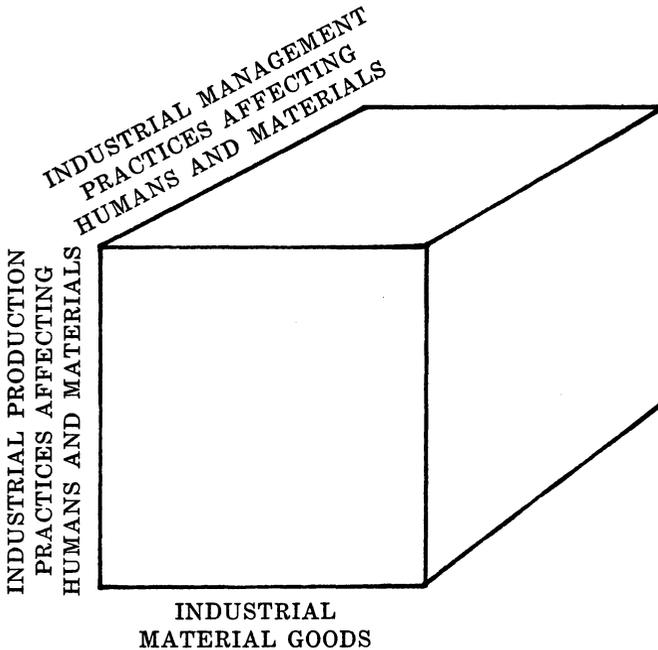


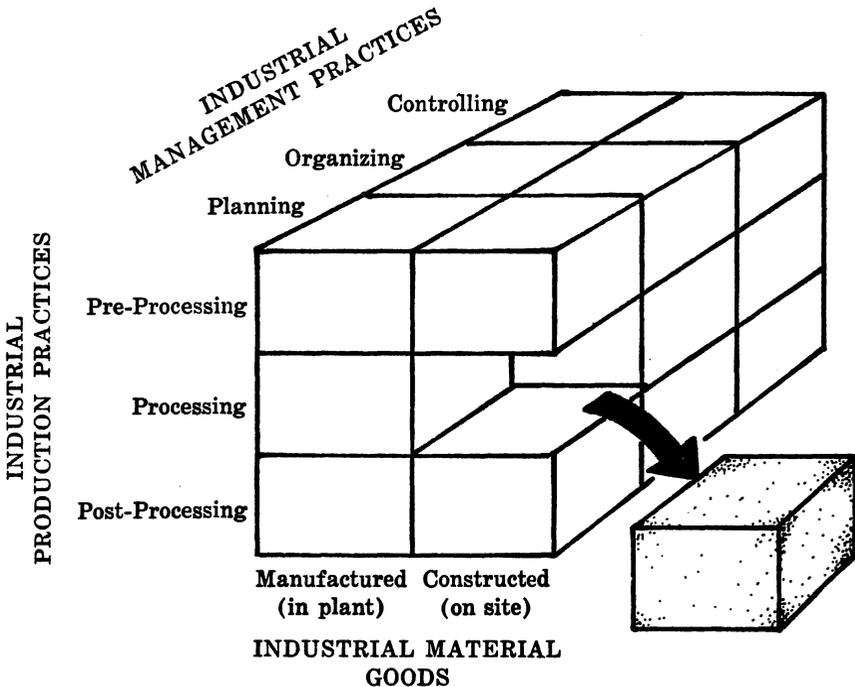
Figure 1. First-Order Matrix of Industrial Technology.

materials. For analytical purposes, the practices which affect human behavior must be distinguished from the production setting. However, it is clear that (for example) the electroplating process cannot be separated from concerns for properly exhausting noxious fumes and for providing proper protective shielding for workers. Industrial health is distinguished as a universal concern which relates to practices throughout the establishment. This fact becomes evident when its many related practices are placed within some meaningful, all-encompassing construct. Thus, the broadest generalizations about industrial practices to effect worker safety may be identified independently of their specific applications throughout the production environment, and they may not be recognized simply from a random sampling or even from a total assemblage of the vast array of specific practices throughout industry.

## Matrices of Higher Orders

Figure 2 depicts the second-order matrix only of that portion of industrial technology which chiefly affects materials. This follows the pattern introduced in Figure 1, except that Industrial Material Goods have been separated into Manufactured and Constructed Industrial Material Goods. A sample third-order matrix is shown in Figure 3. In this figure, the shaded area from Figure 2 has been expanded to show that setting goals for the project, researching the project, designing the project, and engineering the project are subelements under Planning; while preparing the site, building the structure, and completing the site are subelements under Processing. At this level, Constructed Industrial Material Goods are divided into buildings and non-buildings.

A separate but parallel structure of industrial practices which affect human behavior in industry is shown in Figure 4.



**Figure 2.**

**Second-Order Matrix of Industrial Technology Affecting Materials.**

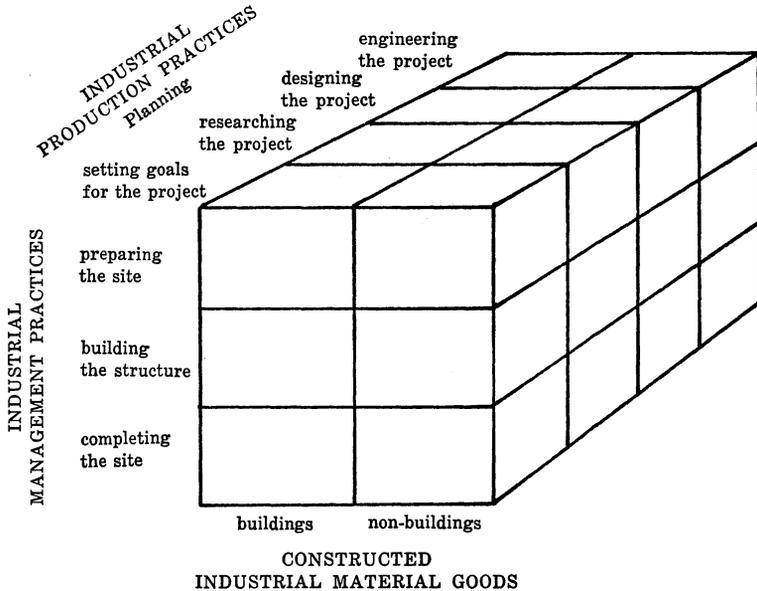


Figure 3.  
Sample Third-Order Matrix of Industrial Technology Affecting  
Constructed Material.

These practices are planned, organized, and controlled by management as they affect humans through practices of hiring, training, working, advancing (up, down, or out), and retiring. These practices often are different for manufacturing than for construction. Their similarities and differences provide further insight into their nature.

It should be repeated that while one can look separately at industrial practices which primarily affect materials and those which primarily affect humans, their interrelationships in the production setting are at least as important as their separate entities. It is this latter fact that often is ignored when either type of practice is studied—something an adequate industrial arts program should not do.

The matrix scheme used in this analysis provides a unique way of looking at the multiple dimensions of this body of knowledge. Levels of specificity may be added to the model on all or on selected dimensions. It is impossible, for example, to expand the "industrial production" axis to a high level of refinement,

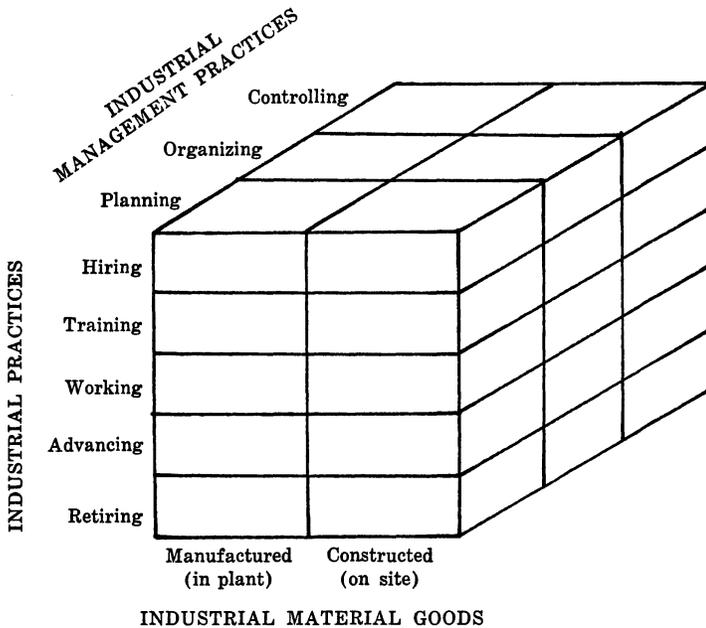


Figure 4.  
Second-Order Matrix of Industrial Technology Affecting Humans.

while retaining the generality of the "industrial goods" and the "industrial management" dimensions. If all three dimensions were extensively developed, it would be theoretically possible to select an infinite number of "tailormade" combinations of subject matter from the matrix. Thus, while the primary responsibility of the Industrial Arts Curriculum Project was directed toward industrial arts at the junior high school level, the principal analytical device (the matrix of industrial technology) has potential applicability at all grade and sophistication levels.

The matrix approach may prove equally helpful in conceptualizing and codifying other technologies. The rationale for including a study of industrial technology in the school program suggests that these other technologies (e.g., marketing, transportation, and health) also should be studied in the school program. Educators should undertake the structuring of the knowledge of all technologies, and industrial arts personnel should be leaders in this developmental task.

## PSYCHOLOGICAL AND SOCIOLOGICAL CONSIDERATIONS

The identification of the body of knowledge to be studied is only one of the several major determinants of the nature of a curriculum. A body of knowledge may be studied in a thousand ways. Also, the teaching-learning strategy, the nature of the teacher, the nature of the facility, and the nature of the learner—all must be seriously considered, as they affect the program.

In designing programs in response to the individual and social needs of people, it should be noted that *industrial arts is not a vocational subject*. It is conceived and should be taught to provide some of the essential learnings (liberal education) needed by all educated citizens in an industrialized democracy. Some students may elect to use the knowledge and skill gained in industrial arts to enhance their employment opportunities, but that does not make the program vocational. It must be remembered that students also use knowledge and skill gained in common school programs in English, mathematics, art, music, social studies, and science to enhance their employment opportunities. To call this education vocational simply because it has application to employment requirements is to lose any useful purpose for the term.

Recent vocational legislation has complicated the problem of determining what vocational education is, but individual states must be careful to avoid a dualistic (and, therefore, undemocratic) system of education based upon the notion that persons seeking employment after high school should be separated from those who are going on to further formal education. The essentials of education for citizenship must take priority over all other educational concerns, and all citizens should learn together in a common school, just as they must function together in society. And *industrial arts is an element of the educational program which provides the essentials for enlightened citizenship*.

For centuries societal leaders have searched for a more effective liberal education program for the common man. Classical academic education has endured while the quest has continued.

During the past century, leaders such as Calvin Woodward, Nicholas Murray Butler, John Dewey, F. Gordon Bonser, William E. Warner, and Gordon Wilber have recommended additions to

the classical tradition in the form of constructive activities. All their arguments possessed a common thread. Youth, in an industrialized culture, cease to acquire naturally all of the knowledge of industrial practice which their life styles demand. Because of this, the schools have a responsibility to provide this knowledge through practical experiences integrated with basic citizenship education and duplicating, or at least simulating, the experiences encountered in life outside school.

Those who have advocated industrial technological studies as an essential school program element, regardless of the student's career aspirations, have never sold the public or, most particularly, the legislators on two basic premises:

1. There are persuasive arguments, in a democratic society, why there should be common (as opposed to a dual) comprehensive educational system for all youth. This would imply that there is something fundamentally wrong with the concept of dual boards of education, dual tax structures, dual administrative channels, area vocational schools, and other standard vocational education operating procedures unless they are extensions of a basic citizenship education under the control of a unitized management system. The value of separate schools is subject to serious question when they are seen as equal and parallel operations.

2. Technological knowledge is a discrete and defensible body of knowledge comparable to the humanities and sciences and mathematics. This body of knowledge should be accounted for in the common educational program of all youth in order to provide them with the technical literacy which will enable them to select a technical occupation, but will also help them to consume wisely the products of technology, appreciate their social and cultural implications, understand the techniques of their efficient operation and servicing, and choose well among hobbies and recreational activities.

Industrial arts educators have always maintained that they were providing for general industrial literacy, but they have been unable to bridge the gap between theory and practice in operating programs. In the main, industrial arts continues to be woodworking, metalworking, and drawing. With widespread curriculum innovation during the past decade, the theory-practice gap has been diminished. The pace of this work has been slowed because there have never been other than local and state monies,

on the same basis as they are distributed to all other operating programs in the school (with the exception of such areas as vocational education and selected other federally-funded programs), to support changes which require inservice education, expensive and sophisticated equipment, and unusual physical plant costs such as high-voltage electrical services and exhaust systems.

Some courses of action seem to hold unusual promise:

1. Cooperatively with vocational educators, industrial arts educators should make an effort to distinguish between the many and important programs which prepare people for job entry and those which are inseparable from common citizenship education for all youth. Tradesmen-teachers and separate schools may be appropriate for the former programs, while regularly certified professional educators and comprehensive schools, under a single administration, should characterize the latter.

2. General home economics and industrial arts educators at all levels should remain full working partners in technology-based programs for liberal education purposes for all age-grade levels, along with agricultural and business educators and all others, regardless of the source of supporting monies, and they should not have to occupationalize their subject matter in order to participate in joint planning councils with vocational educators. The principal focus of technology-based programs for all youth must continue to be how to solve all of life's problems, not just those related to how to make a living.

3. The liberal education needs of youth must continue to be the primary criterion on which judgments about educational programs are based, and whether or not there are federal monies available to support a particular kind of teacher and particular kinds of programs must not be the controlling factor in deciding particular program worth.

4. Every possible effort should be expended to break down the barriers between the technologies and academics, and vocational education must be enjoined not to widen the breach through separate planning, programing, and budgeting.

5. Industrial arts curriculum workers should reach a common agreement concerning the scope and nature of their subject matter. If industrial technology is agreed upon as the source of the knowledge and skills industrial arts is concerned with, both "industry" and "technology" must be clearly defined. If tech-

nology totally is the concern of industrial arts, then programs to reflect such a construct must be developed.

6. Teaching-learning strategies must be identified and adopted. They should effectively communicate the essentials of the subject matter.

7. The adequacy of curriculum elements should be judged by whether they: (1) are collectively representative of the total body of knowledge, (2) are composed of program elements which are mutually exclusive, and (3) exhibit a functional agreement. If a claim is made that a program teaches about industrial technology, then even a casual look at the program elements should reflect industrial practices. The program elements should be courses with minimal overlap and maximal interrelationship.

Finally, the total program construct should achieve the purposes for which it was conceived.

If these actions are taken, communications should improve. More importantly, youth will be better served by the liberal arts *and* vocational education.

## PROGRAM DESCRIPTION

In view of what has been presented to this point, it should be noted that a junior high school level integrated instructional system, which is consistent with the expressed rationale, has been developed under the direction of the writers. After six years of research, development, and dissemination, two viable and successful courses entitled *The World of Construction* and *The World of Manufacturing*, have been made available to the profession. These teaching-learning systems have been developed, field tested, and evaluated with pupils of middle school or junior high school age. In their fourth edition (first commercial edition), they are being used successfully in grades six through twelve, though the Project staff does not recommend the materials for use with normal upper-secondary school classes. Central to each course is the activity-centered approach to managed industrial production systems with men and material.

### Possible Curriculum Alternatives

The detailed rationale, plus the developed program for early adolescents, suggest several viable curriculum alternatives for

the upper secondary school years. These may be described briefly as follows:

<i>Option</i>	<i>Description</i>
1	A program based upon a more sophisticated and complex study of construction and manufacturing technologies or even of industrial technology. Instead of planning and designing a scout lamp, design an urban renewal project. Instead of scheduling the production of a lamp, schedule the production of a radio. Instead of installing a simple electrical circuit, install an industrial control system involving electronic circuitry.
2	As above, but divide industrial technology into construction and manufacturing courses and then subdivide each of these into two: heavy or light construction and industrial goods and consumer goods manufacturing. In Option 1, above, the courses would each embrace the totality of the respective technologies of construction, manufacturing, or industry. In this option the courses could profitably be more selectively focused on the technologies of making buildings or non-buildings or of making industrial or consumer products.
3	As above, in Option 1, except divide the construction and manufacturing courses into what management or production personnel do. One construction course would formulate goals and evolve the detailed plans and specifications with which to achieve them. Another construction course would begin with such plans and specifications and implement them. Similar divisions could be made in manufacturing.
4	Much smaller elements of the body of knowledge could be identified and taught, e.g., industrial power technology, graphic communications technology, research and development technology, computer technology, drafting technology, woods processing technology, metals processing technology, plastics processing technology, product fabrication technology, etc.
5	The rationale and structure for subject matter based in industrial technology could be abandoned or modified to provide a different working base for program development, e.g., technology (medical + business + political, etc.), occupations (things specific people do versus techniques used by people), production and services (how to make it new and how to keep it up to minimum specifications), etc.

For many reasons, Option 4 might be the most feasible at this point in time. Some of the most persuasive reasons include: (1) the present inclinations, interests, and abilities of more than 60,000 practicing industrial arts educators enable them to respond to and implement such a program with minimal trauma; (2) the present multi-billion dollar investment in physical plant

could most efficiently accommodate such a program; and (3) more specialists, research, literature, and instructional aids already exist to support such a program. Despite this, the most effective educational program may well be one of the other options.

More specifically, Option 4 might well be viewed as including, for the average senior high school, the program elements named in Figure 5. In the figure, these proposed elements are related to the more traditional program elements which they might profitably replace.

<i>Present Industrial Arts</i>	<i>Proposed Areas of Study</i>
Planning Drawing Design	Research and Development Technology
Woods Metals Plastics	Materials Processing and Fabricating Technology
Electricity Electronics	Electrical Systems and Servicing Technology
Power Mechanics	Mechanical Systems and Servicing Technology

Figure 5. Projection of Senior High School Programs.

## Content

The content of the courses shown in Figure 5 can only be briefly described, since it has been neither conceptualized and structured in detail nor designed into a syllabus. However, the body of knowledge presented earlier, that of industrial technology, suggests the general nature of what would be included.

The studies in research and development technology can be characterized as being focused in that knowledge of industrial practice which involves the management functions of planning, organizing, and controlling the human activities and material processing technology up to the point where the product and the production system are through the prototype stage and ready

for production to begin. The principal organized bodies of knowledge which would make up the subject matter would include industrial psychology, industrial sociology, industrial management, architecture and industrial design, and the various sub-disciplines of engineering.

The studies in materials processing and fabricating technology would focus upon the knowledge of practice of processing and fabricating such assorted products as clothing, TV dinners, dams, skyscrapers, and 747's. The subject matter would be rooted in metallurgy, food technology, and other relevant knowledge of practice of how to affect the form utility of natural materials.

The studies in electrical systems and servicing technology would focus upon the technology of producing and servicing electrical and electronic systems, whether they be in an automobile, air conditioner, wrist watch, interstate power network, or a communications system. The source of the subject matter would be the knowledge of practice possessed by linemen, wiremen, electrical and electronic engineers, and various servicemen.

The studies of mechanical systems and servicing would be similar to those for electrical and electronic systems, except they would be concerned with the knowledge of practice of the mechanical trades and mechanical, civil, and structural engineers. All man-made structures are mechanical systems, so the range of objects of concern would be the totality of industrial production. Even more, these would even be related to the mechanical systems in the structures found in nature, though the primary focus with regard to these would be found in scientific rather than technological studies.

### **Activities**

Activities are absolutely essential to industrial arts programs which claim to teach industrial technology. It, like all technology, is based upon a knowledge of practice or how to do something. It may not be exclusively knowledge about things. It may include much of this but always includes the ability to do. How to fly an aircraft (piloting technology) may not be taught solely in ground school. It must include the practical knowledge and skill of piloting in order to qualify as technological learning. Otherwise it is academic learning.

The activities in the secondary school should involve both

individualized and group projects. In either case, the activities should be broadly conceived to include in their definition both the traditional kinds of predominantly psychomotor activities and the more contemporary ones of research and development, role playing and gaming, and discussions which equally qualify as activity but which involve psychomotor skills in a relatively minor way.

Whatever the activities, they should be perceived to be of value to the extent that they provide reinforcement of cognitive development of broader conceptualizations, for the specific activities have great motivational and reinforcement value but may have short term significance in a rapidly changing technology. The broader conceptualizations have more enduring educational significance. For example, learning a specific welding technique which has considerable contemporary value may be an ideal exercise for reinforcing a concept of combining materials by fusion bonding. Having experienced in practice a detail of this concept, the cognitive learning of the concept may be reinforced beyond the level which otherwise might be achieved by simply reading about it, hearing about it, or observing someone else applying it. However, the specific detail may soon cease to have much if any significance, but the broader generalization about fusion bonding, being one of the major technologies in combining components, will likely have continuing significance. Put most concisely, the specific activities, properly conceived and selected, should be a means to a superior end.

### **Instructional Strategies**

Little is known about the relative merits of alternative methods of instruction. The project method of teaching has been a successful means of individualizing instruction in industrial arts over the past decade. During this present era of emphasis upon individualized instruction and progress in all school subjects, the industrial arts teacher may be tempted to over value and continue to accept this approach to instruction. By no means should it be discarded, but it should be supplemented with more group-paced instruction than most industrial arts teachers are presently using in the classroom and laboratory.

The instructional model presented in Figure 6 has been used most successfully with *The World of Construction* and *The*

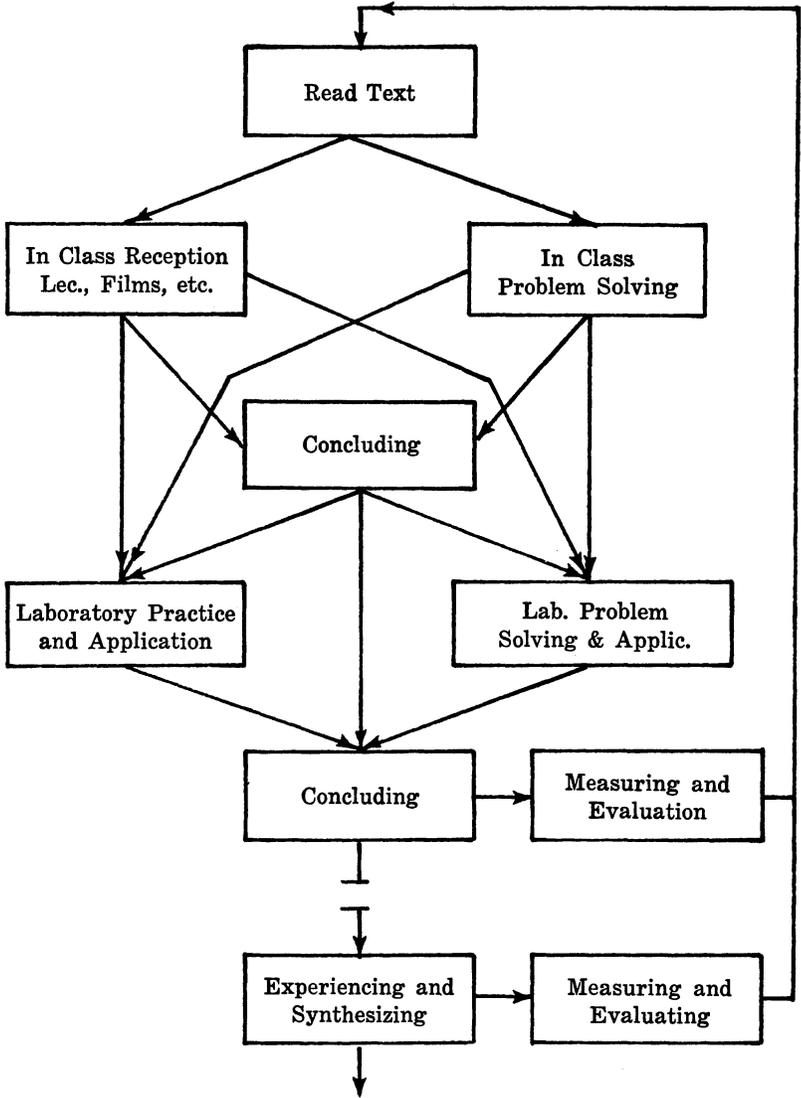


Figure 6. Instructional Model.

*World of Manufacturing* at the junior high level. There is no reason to believe that it is inappropriate for the upper-secondary school. This model implies the use of some major source of cognitive input, such as a textbook, specifically designed for use with the program under consideration, e.g., research and development technology. In addition to out-of-class reading, additional verbal input should be provided during the initial stages of a learning session (lesson). The learner should be required to master verbally (in language) terms and principles and apply them to problem situations. Some level of verbal generalization should be reached at this stage of conceptual development. Then and only then should laboratory reinforcement activities be introduced. They provide the test in reality. Abstract symbols (concepts) take on real meaning through actual perceptual experience in the laboratory setting. At the conclusion of activity, "particulars" and "generalizations" should be related to assist the learner in the accumulation of ever-enlarging conceptualizations of his world—or the industrial technology of his world.

Both individual-paced and group-paced modes of instruction relate to Figure VI. Both should be designed and used with upper-secondary school youth. Since the practices of industry are nearly entirely in the group mode, it would follow that a significant proportion of industrial arts instruction should be group oriented. With limited organized school time available, the writers recommend the group mode as central industrial arts instructional strategies, with an appropriate use of supplementing individualized instruction.

### **Instructional Materials**

The resources for senior high school programs are nearly as vast as the communities in which we live. Resource persons and reference material abound within industry, industrial organizations and societies, and other private and public institutions. To be more realistic, however, it is important to have instructional resources close at hand in the school setting. For this reason, the Industrial Arts Curriculum Project developed two complete instructional systems. Such self-contained instructional packages can and should be supplemented with other available materials.

Some organized, cognitive input is fundamental to efficient instruction. A textbook and/or other organized written materials are central to the individual study mode. In addition, teacher instructional materials (transparencies, films, etc.) and learner materials (manuals, loop films, etc.) are necessary for a balanced instructional program.

Such materials now exist. The problem facing teachers is to organize available components into some semblance of an integrated system. The best approach, but the most costly and difficult, is to tailor-make them, test them, refine them, and make them available to the profession for adoption or adaptation.

### **Facilities Required**

Most of the options proposed earlier lend themselves to the use of existing physical facilities at the upper-secondary school level. Modifications will need to be made as the needs present themselves.

Of all of the principles of laboratory planning, two are of paramount importance. The first, flexibility, cannot be overemphasized. All floor space should be available for several functions during the year. The second, ample storage space, is most essential.

### **Program Evaluation**

Whatever the program design, it will be adequate only if the teacher can answer affirmatively these three questions about it:

(1) Is it relevant? That is to say, is the knowledge and experience gained in it important to out-of-school life in our society? All too many of our educational programs satisfy the requirements for advancing in school but have little or nothing to do with promoting citizenship competencies in the real world.

(2) Is it conceptually adequate? Can a learner identify the elements with which he is working, and can he relate them to larger relationships? Is he studying elements of custom furniture making, blacksmithing, and mechanical detailing because he is told that through them he can gain an understanding of contemporary industry? Such nonsequiturs must be challenged for their illogic.

(3) Do leaders in your community agree with your answers to the first two questions? An objective appraisal of your conclusions, by your colleagues and industrialists, as well as by student leaders, can help validate them.

### BEHAVIORAL OUTCOMES

Since this chapter has not presented any one specific set of program elements for the upper-secondary school, but has only suggested several options which grow out of the IACP rationale, this section will be brief and rather general. Terminal performance objectives, in behavioral terms, can only be developed in detail after learning activities have been determined. Therefore only broad program outcomes or goals are presented here.

At the upper-secondary school level, industrial arts should serve to promote the following six broad, behavioral outcomes: (1) cultural awareness, (2) technological literacy; (3) career awareness, orientation, exploration, and preparation; (4) consumer competency; (5) vocational-recreational expression; and (6) social-psychological growth and development. Although there may be a tendency to place the third outcome, above, in a focal position (because of our historical relationship to vocational education), it is the position of the authors of this chapter that all outcomes must be emphasized in a complete program. Any single course may be developed to promote a single outcome such as the development of hobby interests and skills, but courses may serve two or more of the broad purposes recommended.

In order to have industrial arts recognized as essential, liberal education for all youth, these broad behavioral outcomes must be programmed into our course offerings. The magnitude of the task is great. The profession must be up to the task.

### REFERENCES

- Bellack, A.A. "Conceptions of Knowledge: Their Significance for Curriculum." *The Nature of Knowledge: Implications for the Education of Teachers*. Edited by W.A. Jenkins, Milwaukee, Wisconsin: The School of Education, University of Wisconsin, 1961.

- Bellack, A.A. "The Structure of Knowledge and The Structure of the Curriculum." *A Reassessment of the Curriculum*. Edited by D. Huebner. New York: Bureau of Publications, Teachers College, Columbia University, 1964.
- Broudy, H.S., B.O. Smith, and J.R. Burnett, *Democracy and Excellence in American Secondary Education*. Chicago: Rand McNally and Company, 1964.
- Cassirer, E. *The Problem of Knowledge*, New Haven: Yale University Press, 1950.
- Gardner, J.W., et al. *The Pursuit of Excellence—Education and the Future of America*. Special Studies Project Report V, Rockefeller Brothers Fund, New York: Doubleday and Company, Inc., 1958.
- Hanna, P.R. "Structure of Knowledge: The Interrelationship of Ideas," *The Nature of Knowledge: Implications for the Education of Teachers*. Edited by W.A. Jenkins, Milwaukee, Wis.: The School of Education, University of Wisconsin, 1961.
- Industrial Arts Curriculum Project, *A Rationale and Structure for Industrial Arts Subject Matter*. November, 1966. xxiii + 358 pp. ED 013 955 \$13.16 or \$0.65 microfiche from ERIC.
- Industrial Arts Curriculum Project, *Final Evaluation Report to USOE*. August, 1971, xviii + 377 pp. ED 054 389 \$13.16 or \$0.65 microfiche from ERIC.
- Industrial Arts Curriculum Project, *The World of Construction*. Bloomington, Illinois: McKnight & McKnight Publishing Company, 1970. (Complete instructional system.)
- Industrial Arts Curriculum Project, *The World of Manufacturing*. Bloomington, Illinois: McKnight & McKnight Publishing Company, 1971. (Complete instructional system.)
- Kotarbinski, T. "Praxiological Sentences and How They Are Proved." Section IV, *Logic, Methodology, and Philosophy of Science*. Edited by E. Nagel, et al. Stanford, California: Stanford University Press, 1962.
- Lux, Donald G. "Implications of the Recommended Goals for Public Education in Texas as Viewed by an Industrial Arts Philosopher." Paper presented to Phase II of the Texas Industrial Arts Curriculum Study. Austin, Texas, May, 1970.
- Lux, Donald G. and Willis E. Ray, "Toward a Knowledge Base for Practical Arts and Vocational Education," *Theory Into Practice*, Vol. IX, No. 5, Dec., 1970, pp. 301-308.
- McKeon, R., ed. *Introduction to Aristotle*. New York: The Modern Library, 1947.
- Maccia, E.S. *Curriculum Theory and Policy*. Occasional Paper 65-176, Educational Theory Center and Social Studies Curriculum Center, Columbus, Ohio: The Ohio State University, 1962. Mimeographed.

- Maccia, E.S., and G. Maccia, *The Way of Educational Theorizing Through Models*. Occasional Paper 62-111. Educational Theory Center, Columbus, Ohio: The Ohio State University, 1962. Mimeographed.
- Phenix, P.H. *Realms of Meaning—A Philosophy of the Curriculum for General Education*. New York: McGraw-Hill Book Company, 1964a.
- Phenix, P.H. "The Architectonics of Knowledge," *Education and the Structure of Knowledge*. Edited by S. Elam. Chicago: Rand McNally and Company, 1964b.
- Phenix, P.H. "The Disciplines as Curriculum Content," *Curriculum Crossroads*. Edited by D. Huebner, New York: Bureau of Publications, Teachers College, Columbia University, 1962.
- Polanyi, M. *Personal Knowledge, Toward a Post-Critical Philosophy*. Harper Torchbooks, New York: Harper and Row, 1964.
- Schwab, J. J. "Problems, Topics and Issues," *Education and the Structure of Knowledge*, Edited by S. Elam. Chicago: Rand McNally and Company, 1964.
- Tykociner, J.T. "Zetetics and Areas of Knowledge," *Education and the Structure of Knowledge*. Edited by S. Elam. Chicago: Rand McNally and Company, 1964.
- Venn, G. *Man, Education and Work*. Washington, D.C.: American Council on Education, 1964.

# The Application of Technology in the Solution of Major Problems that Face Mankind in the Future

*Donald Maley*  
*Head, Industrial Education Department*  
*University of Maryland*

This is a senior high school program that has been developed in the Industrial Education Department of the University of Maryland. It is designed as a follow-up experience to the "Maryland Plan for Industrial Arts" at the junior high school level.

The essence of this senior high school program is a recognition and acceptance of the fact that technology will play an ever-increasing role in the solution of certain problems that face mankind in the future. These selected problem areas include:

- Transportation.
- Housing.
- Communications.
- Power generation.
- Production.
- Pollution.
- Resource utilization.
- Trash and waste disposal.

There also is the assumption that the Industrial Arts laboratory is the logical locus for such a program in the public school. This assumption is further strengthened by the fact that the Industrial Arts teacher has had a strong interest in and relationship with the applied aspects of technology.

The program involves rich potential for individual and group study, investigation, planning, construction, reporting, observation, evaluating, and problem solving. There also exists rich potential for direct field experiences depending on the problems studied and the geographical location of the school.

The program was first presented as the substance of an EPDA Summer Institute at the University of Maryland in 1969. This was a teacher preparation program and attracted Industrial Arts teachers from more than a dozen states. The program has been tried out and successfully run at both the junior and senior high school levels. However, it must be emphasized that it is intended for the upper grades as will be evident by the context that follows.

A graphic analysis of the several aspects of the program is presented in Figure 1.

### PHILOSOPHICAL RATIONALE

The philosophical rationale for a program that is radically different in focus as well as context is generated by the period in time as well as the nature of the society in which the program is to function. The "time" and "circumstances" of this development gives rise to the following points in a philosophical rationale.

1. The present and future are characterized by an accelerating-changing society unlike any other in the history of mankind. The nature, dimension, and frequency of change experienced by the present and future generations makes new demands upon nearly every individual as compared with the demands upon those who lived in past centuries where their tomorrows were very much like their yesterdays.

This is a "now" and "future" oriented program that should enable the individual to anticipate certain kinds of changes in society and to have in some degree studied or evaluated some of the alternatives in the changing world.

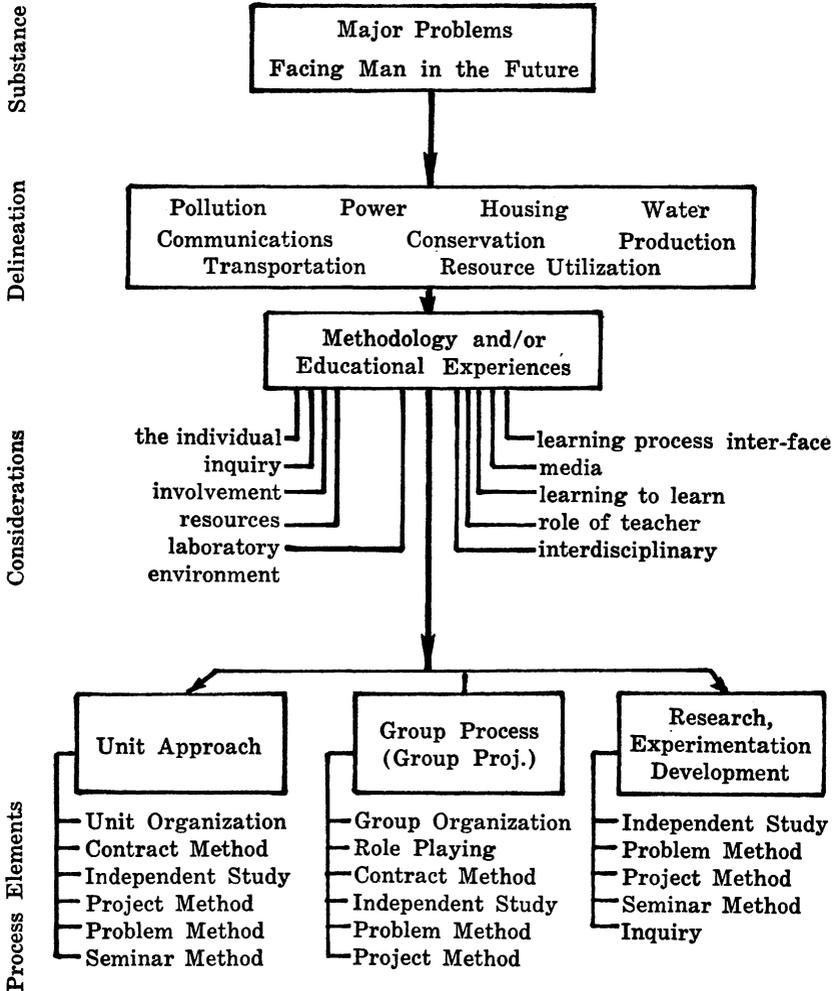


Figure 1. Graphic Analysis.

It is in a sense a program that is aimed at developing decision-making and the facilitation of change in a rapidly changing world.

2. The program is designed to establish a high degree of "relevancy" between that which goes on in the school and that which exists in the world outside. The past is cast in the pages and crust of time and there is little if anything the high school

student can do about it. The present high school generation has demanded a meaningful role in the shaping of the future. This can be accomplished by having the school actively involved in the principal issues and problems facing the society.

Jerome Bruner had an appropriate comment along these lines in an article appearing in the *Saturday Review*.

This brings us directly to the problem of relevance, the thumb-worn symbol in the modern debate about the relation of education to man and society. The word has two senses. The first is that what is taught should have some bearing on the grievous problems facing the world, the solution of which may affect our survival as a species. This is social relevance. Then there is personal relevance. What is taught should be self-rewarding, or "real," or "exciting," or "meaningful." The two kinds of relevance are not necessarily the same. (p. 68)

All about us there is the need for better solutions to the problems generated by a society that will double its population in thirty years. The mandate for relevancy need not be an idle dream or an educational hope. It can be a reality by having the school actively involved in the study and solution of the major issues facing society. This program that has centered upon a number of major societal issues can provide an answer to the cry for relevance as it studies the application of technology toward the solution of such problems.

Dr. John Goodlad in an article titled "The Educational Program to 1980 and Beyond" has urged a look ahead in curriculum development.

... get into the curriculum the problems likely to be facing young adults in 1980. These persons currently are in the primary years of schooling. If we were to begin now, we could plan for them a junior high school curriculum organized around problems of population, poverty, pollution, and many more. (p. 57)

3. There are two obvious polar positions regarding the function of education. One is related to the "preservation of the culture" concept, and the second stresses the importance of education as a "change agent." The pace of contemporary society makes it obviously clear that if the school is to have a meaningful role, it must assume a "change agent" posture.

Louis H. Rubin made an excellent statement which pertains to this concept when he stated:

. . . we can no longer afford the kind of formalized education which takes the child into the future with his gaze fixed steadfastly on the past. Somehow we must convince our patrons that it is more important to help the child to think about the next civilization than to require him to remember the facts of the last one. (p. 24)

This senior high school program is devoted to the study of new and different applications of technology. As such, the student will be involved in the study and examination of needed changes in solutions. The program will encourage the student to actually project changes in present solutions as well as evaluate alternative solutions. It is felt that as one studies proposed changes in solutions, there is an increased anticipation of change on the part of the individual.

4. Another point in the philosophical rationale of this program deals with the idea that technology will and must play an increasing role in the solution of major problems facing mankind.

An ever-increasing population will create newer and heavier demands for housing, food, transportation, production of material goods, power and energy, as well as greatly expanded water sources and trash disposal systems.

The increase or improvement in the quantity or quality of any one of these items consistent with the needs of society will demand technological applications of a new dimension. Increased agricultural or food production on less and less space is surely a task for technology to solve.

The increased demand for fresh water cannot be met without the application of technology, just as the ever-increasing demands for power and energy sources will be satisfied only by the application of technology.

The central point is not that technology is the only solution. Certainly, there are important roles for the social engineer, but increasing the supply of water, electricity, or food cannot be accomplished without the effective application of technology. It is felt that many of the present-day problems could be overcome in such areas as housing, communication, fresh water, power generation, and pollution if the decision-makers were apprised of the existent potentials of technology.

The technology to deal with many of these problems already exists.

### To quote James Bernardo:

Dr. Lee A. DuBridge, President of the California Institute of Technology, has said that from a purely technical standpoint we know enough to—

1. Produce enough food to feed every mouth on earth—and to do this even though the population may double or triple.
2. Make fresh water out of sea water and then irrigate all of the world's arid regions.
3. Produce enough energy from uranium to light and heat our homes and offices, electrify our railroads, and run all of our factories and mills.
4. Build houses, buildings, and indeed whole cities, which are essentially waterproof, heatproof, cold proof and storm proof. (p. 13)
5. The study of the applications of technology will have another important function in narrowing the gap of technology ignorance that exists between the technical elite and the great masses of people, who through the democratic processes, eventually are responsible for the direction that society is to go.

One must see this problem in what may be called the two generations of technology. First there are the theoretical and basic research aspects which require an indepth understanding and sophistication that would be understood by a relatively few people. This first generation idea is illustrated in the basic principles and concepts that underlie the development of atomic energy, the laser, linear induction propulsion, DNA/RNA systems, antibiotics, microminiaturization, crystallography, invisible electronic linkages, and many more. The indepth understanding of the basic principles and concepts behind these ideas and many others fundamental to life, the nature of the universe, and the potential use of matter can be the province of only a few whose specialized talents and interests are instrumental in pushing back the frontiers of knowledge basic to the areas.

The second generation is the application of the products of the first generation of knowledge. It is at this point where social values, direction, and societal wants as well as needs play a very important part. It is here where another and very significant group within the society takes the productivity of the pure scientist or researcher and transforms the principles and concepts into nuclear reactors, antibiotics, vaccines, transmission systems, etc.

This second generation or applied technology level is where the greater masses of people must become better informed. It is here where the issues of societal needs and directions are satisfied or neglected. It is at this point, if people are interested in controlling their own lives, that the gulf of technological ignorance must be narrowed significantly.

The resultant of an expanding gap may well be a lack of progress, improper decisions, wasted energy, hunger, strife, and societal stagnation. The history of mankind is filled with illustrations of technological ignorance that greatly impeded the development of man's ability to furnish his necessities as well as expand his horizons.

The contention that persons ignorant of technology can function in a democracy to any affect when the society is a technological one is dubious. Understanding is not a prerequisite of control, it is control. (Fabun, p. 30)

6. The final point in this philosophical rationalization is related to the democratic processes and the requirements of the contemporary citizen in meeting his obligations at the polling place, the town meeting, the local political caucus, or letters to the editor.

The issues of today and tomorrow concern themselves with the development of water resources, constructing better housing, generating new and better power sources, cleaning up and recycling the millions of tons of trash and waste, developing more effective transportation systems, and many more. How are such issues resolved? How does the educational system enable the voting public to make decisions based upon understanding?

### Summary

Past generations of citizens in democracies have not been faced with the complexities and the levels of knowledge required of contemporary man simply because of the more simple nature of past societies as well as the lower level of technological developments.

The decisions required to build a road from New York to Boston in the early 19th century were considerably different and much less complex than those associated with modern high-speed highways, the turbo-train, or jet transports today.

Likewise, the issues and problems of transatlantic flights in the early 1950's with four-engine propeller-driven planes were considerably different and much less complex in nearly every dimension than those issues and problems associated with supersonic flight.

The very concept of democracy as a form of government by the people clearly tells a story of new requirements for education for contemporary man. There is no attempt in this presentation to even begin to infer that Industrial Arts or this senior high school program is the answer to all of man's pressing problems, even as they relate to the applications of technology.

The substance of this program is simply to identify a number of major problems and explore the applications of technology in their solution. The specific problem areas were identified in view of the nature of the potential for carrying out a meaningful study by the Industrial Arts teacher, as well as the immediate and expanded environment in which he can function.

### PSYCHOLOGICAL RATIONALE

The psychological rationale for a program such as this should be based upon those factors which contribute significantly to the drives, motivations, wants and needs of the individual. It should attempt to answer such questions as:

1. Why should the particular students become appreciably involved in the program?
2. How does the program deal with the individual differences of interests, abilities, and motivations?
3. How does the program contribute to a positive self concept and an opportunity for identity?
4. How does the program contribute towards the desire for meaning and relevance as identified with the age group associated with the program?
5. How does the program with its various strategies and forms of involvement promote the learning processes?

It is felt that each of these questions is valid and appropriate for this new senior high school program. The following discussion will attempt to provide some of the answers as they relate to this particular educational experience.

*The program permits a great deal of opportunity for the students to establish individual and group goals. This process functions especially well in the group project organization, the research and development phase and the unit approach. The contract system which is appropriate to each of these strategies is another specific instance and opportunity for goal setting. It also is important to note that experience with these strategies has demonstrated that the students generally establish higher and more difficult goals than the teacher would ordinarily promote.*

*The program provides for a vast range and diversity in forms of student involvement. The kinds of potential experiences range from the real and concrete to high abstractions as well as from the manual to the mental. There are opportunities for the verbally inclined, the creative and ingenious, the makers, doers, leaders and followers. The means of expression are limited only by one's imagination. Each individual is given the opportunity to demonstrate and apply his unique talents as he contributes to the goals of the group or class. Just as a community consists of numerous individuals, each contributing in his unique way, so it is with this program that permits the freedom and opportunity which enables one's uniqueness to function and demonstrate its effectiveness.*

*The program is structured to take advantage of individual and group interests. The selection of a major problem for a group study is based upon the interests of the class. The role one selects in the project organization, and the component he selects to develop on the project are also of his interest. The major unit topic (a major problem area) is selected by the class, and each student in the unit strategy identifies the particular element that he contracts to contribute to the unit study. The selection of problems in the Research and Development strategy likewise is made by the individual student.*

However, aside from these mechanical forms of interest inherent in the methodology there is in the very substance of the program a great potential for the development of interest. The timeliness and the reality of the issues to be studied provide another important source of interest generation.

*The program is centered at the senior high school level to take advantage of the developmental stage of that age group.*

These students want to be involved. They want a piece of the action. The new voting age of eighteen has put the newly franchised in many of the seats of our secondary schools. The issues of the program are in essence the issues of the ballot box, the political arena, and the local state, and national legislative chambers.

Our secondary school students . . . want to see themselves as participants in the world they live in, not as apprentices for it. They want the world to be in the school and the school in the world. (Foshay, p. 352)

Involvement in the issues of pollution, housing, transportation, power generation, etc., is an involvement in reality.

It is important to note that involvement is not just a topical consideration, although that is important. This program provides the opportunity for many kinds and forms of human involvement with the content, organization, and activities associated with it. The various strategies are replete with involvement opportunities reaching into nearly every form of productive learning experience.

There also is the opportunity for actual participation and involvement in on-going community projects, planning, and studies.

Another point in the psychological rationale deals with the opportunities *the program offers for each individual to become a "somebody" in his group and to enhance his "self concept"*. Experience with the unit, group and Research and Development strategies has sufficiently demonstrated that each individual has many opportunities to be an expert among his peers, to demonstrate his unique talents, and to contribute in various ways that are not possible in most secondary school classes.

As each individual takes on a different sub-topic in the unit study of a major problem, he invariably goes beyond the understanding of his classmates in his knowledge of the sub-topic. This fact has been observed even in those classes where there is a reasonable spread in ability.

Role playing is another experience associated with the program that contributes significantly to a strengthening of the "self-concept" particularly when the role is of the student's choice.

*The program is in many ways a response to the cries for "relevancy", for "meaning", and for "reality."* The issues, problems, and sources of information belong to the "now" generation. They are issues with "meaning" and are significant to the growth and development of our way of life as well as the kind of living to be experienced in the future. The "hard" content is not something that was written by persons in previous generations. The literature of this program is as fresh and contemporary as the morning paper, the daily telecast, or the unpublished commission report. Unlike the issues of yesterday that occupy much of what is studied in our schools, this program is related to the issues of today and tomorrow. Relevance and meaning are highly related to one's relationship to the issues under consideration. It is a matter of what one can do about the issue, what impact the individual can have, and what influence one can have in shaping the outcome. This point was emphasized by Fred Wilhelms:

Yet, even more fundamentally, all the youth of our day are growing into an age of uncertainty about themselves and about their significance . . . They are threshing about, often in crudely rebellious or even bizarre ways; but the important thing is that they are searching, impelled by a fine idealism and relentless honesty. They deserve our help. And to give it to them we shall have to shuck off a lot of scholastic impedimenta and go to where a young person meets the realities of adulthood. (p. 15)

The program in this discussion goes a long way towards satisfying these qualifications for relevance and meaning.

A final point in the psychological rationale deals with *the Gestalt of the study experience*. It is a program that attempts to examine problems, causes, variations, solutions, alternatives, and effects. The procedures and strategies are highly interdisciplinary in their applications to the problem or a phase of the problem.

The study of relationships and contributing factors are just as important as the identifying of proposed solutions and the possible impacts upon society.

The concept of "wholeness" is not limited to the "hard" content of the program. It also is found in the "process" functions identified with the various strategies. The activities and experiences contribute significantly to numerous aspects of the total development of the individual. This is exemplified in the

student's involvement in communicating, problem solving, researching, inquiring, planning, constructing, challenging, leading, following, receiving, helping, evaluating, analyzing, and projecting.

## PROGRAM DESCRIPTION

### Contents

The content of this senior high school program in Industrial Arts centers around major societal problems facing mankind in the future.

Specifically, the program deals with *the application of technology in the solution of major problems facing mankind in the future*. The problems that have been identified for study include: transportation, housing, communications, power generation, production, pollution, resource utilization, and trash or waste disposal.

The content related to each of these problem areas does not exist as a static set of facts to be learned; dates, leaders, or events to be memorized; or many other common elements of traditional school subjects. The sources of data and the conditions of the problems under study are constantly changing and developing.

As an example, let us take the problem of transportation as a major problem facing mankind in the future. The content in this area takes on two different but contemporary forms of educational involvement. On the one hand there is the content that relates to the problem, which in this case is the "application of technology in the solution of transportation problems facing mankind in the future".

The second and complementary form of content deals with the "process" concept of educational outcome. Both the "problem" and the "process" facets of the content will be discussed in the following sections.

The content related to the "transportation problem" grows out of a number of selected questions that relate to the issue. Such questions may take the following form.

1. What is the nature and extent of the transportation problem facing mankind in the future?

2. What are the elements contributing to the nature and extent of the problem?
3. How does the problem differ for various elements within the society?
4. What are the projected solutions for the various aspects of the transportation problem?
5. What are the alternative solutions and the relative merits of each?
6. What are the technological advancements or developments that will play important roles in the projected solutions?
7. What are the projected societal impacts of the identified solutions to the problem? Occupational? Social relations? Population movement? Population concentration? Life-styles?

The same kinds of questions would be used to generate the "hard" content for each of the other problem areas mentioned earlier in this section.

The "process" component of the content is based upon the kinds and forms of knowledge and skills that the individual accumulates in his pursuit of the previous problem elements. Such knowledge and skills are involved with the means by which the problem is studied and not the specific or generalized answers that pertain to the particular societal problems under study.

As an example, one may learn the "skills of inquiry" in order that the appropriate data on the transportation problem be gathered. In this case the knowledge contributing to the "skills of inquiry" are in the category of "process" content and the data resulting from the inquiry would be in the category of "hard" problem content.

The content that would fall into this second or "process" grouping would include the skills and knowledge related to such activities and forms of human involvement as:

1. Inquiry,
2. Problem solving,
3. Interacting with others,
4. Exploring,
5. Challenging,
6. Evaluating,
7. Constructing,

8. Designing,

9. Using.

There are, of course, many others that may be identified, and they will vary with the approaches and activities involved in the individual's pursuit of the topic. It is important to note that the quality and quantity of the "hard" content which is generated with respect to the major societal problems will depend in a large measure on the extent to which the "process" content components are developed.

This concept of "process" content is not altogether new to Industrial Arts teachers since they have been claiming for years that the "project is simply the means to the ends they seek." One might speculate that the "process" by which one gets the answers might be more important than the answers he gets.

### Activities

The principal sequence of events that form the "involvement structure" from which the many activities generate is as follows.

1. Selection of a problem.
2. Researching the problem.
3. Developing the report.
4. Constructing the model, replica, or apparatus.
5. Presenting the information and the construction.
6. Discussing and evaluating the solution(s).

This basic "involvement structure" is varied dependent upon the particular strategy used, i.e., the unit approach, group project approach, the research and experimentation procedure, or the community cooperative experience approach.

The activities carried on by the students in this program reach out into many and diverse forms of human involvement. These activities are listed under general topical headings as follows.

#### 1. Problem Associated Activities

*Identifying* the problem

*Stating* the problem

*Identifying* the elements contributing to the problem

*Determining* the different forms of the problem

*Identifying* projected solutions

*Projecting* alternative solutions

*Listing* technological implications for the problem

*Speculating* on societal impact

*Pursuing* a planned sequence of action

## 2. Process Associated Activities

Researching

Analyzing

Discussing

Challenging

Inquiring

Constructing

Designing

Interacting

Evaluating

Comparing

Experimenting

Relating

Correlating

Presenting

Leading

Following

Speculating

Projecting

*The program is based upon problems with implications that extend across many subject or discipline areas. This requires a highly inter-disciplinary approach that extends into an involvement with most areas of the school.*

*The program is based upon societal problems that affect a large percentage of the population as well as most areas of living. This quality provides a real opportunity for the program to move out into the community for the source of data, as well as a physical location in the community in which to carry out certain activities. The students could actually be involved with on-going conservation or salvage projects, community planning sessions, housing and transportation projects in the community, and a host of other forms of meaningful engagement with the real problems of a changing society.*

*The program is designed to make extensive use of the Industrial Arts laboratory facilities as the students construct various forms of models or replicas pertaining to the problem*

areas studied. The design, construction, and testing of various forms of physical objects related to the problems under study constitute another kind of student manipulative activity.

Further manipulative activities may be carried on out in community settings or project locations where the students become active participants in problem projects under real and concrete circumstances.

*The engagement of students as interns or cooperative student assistants* in projects involving conservation problems, community planning, transportation systems design, housing studies, etc., are other forms of student activity possible under such a program.

*Another prominent group of student activities center around the regularly scheduled seminars* in which each student or group of students present their problem and the associated findings, construction, ideas, or conclusions. It is here where the activities of presenting, leading, challenging, helping, interacting, and communicating are carried out in an organized and effective manner.

The range of kinds and forms of student activities is endless and is bounded only by the imagination of the teacher and the real or imagined restrictions imposed by the educational establishment itself.

### **Instructional Strategies**

There are four major forms of instructional strategies associated with the program. Each of these has been carried out in teacher education classes as well as in the public secondary schools.

The first of these is the *unit approach* to the study of the application of technology in the solution of one of the major problems facing mankind in the future. The *unit approach* would involve the total class taking on (by their choice) one of the problem areas for study.

The unit topic under consideration might take the following form:

1. Housing Needs and the Future with Implications for Technology and Human Ingenuity.
2. Pollution Control and the Future with Implications for Technology and Human Ingenuity.

### 3. Power Generation and the Future with Implications for Technology and Human Ingenuity.

The same form of topical titles could be used for the problem areas of transportation, conservation, communications, production, and resource utilization.

After a unit topic has been decided upon, each student in the class takes on a different component or aspect of the problem. He or she will investigate the application of technology towards its solution. The principal point here is that each student selects his own area of the major problem for study, and that each individual is investigating a different component or aspect of the problem.

The educational strategies built into this unit form of instructional format include the contract method, independent study, project method, problem method, and the seminar method. It is actually a combined system of educational strategies with an effective interface of several appropriate forms of pedagogical practice.

The second strategy is based upon a total *class or group study of a major problem*. All efforts are directed towards the same problem and all construction leads to a single major group project.

Outstanding group projects in this category have generated from the study of such technological developments as:

1. The Desalination of Sea Water.
2. The Generation of Electricity from Nuclear Sources.
3. Advance Developments with the Picture Phone in Communications.
4. Future Housing Forms on the Land, in Space, and Under the Sea.

This group process not only leads to the development of some form of a major construction project, it also involves considerable research, inquiry, planning, organizing, presenting, and evaluation.

The class conducts a great deal of its program by means of a personnel organization plan comparable to that used by the "project" industries in everyday business. Each student assumes a leadership role as well as a followership role in the personnel plan. Such leadership roles include project director, public relations director, construction director, research director,

safety director, educational director, industrial relations director, purchasing director, project coordinator, and many more.

The followership roles normally involve working on construction teams, research teams, and other activities related to the total effort.

This group project strategy provides many opportunities for extensive community involvement, guest speakers, field trips, movies, and a wide variety of media applications.

The third strategy that has been used is *research and development*. Each student selects a problem of his interest from the seven or eight broad areas identified earlier in this presentation.

The initial class activities involve the student in identifying and clarifying his problem. The scientific approach to research and development is basic content in this phase of the program. The student is required to get involved in "hands-on" kinds of projects and not merely literature studies.

The research and development process is greatly enhanced by periodic seminars in which the students are given an opportunity to present their work and to be challenged as well as assisted by fellow classmates. These seminars are under the leadership of students on a rotating basis and include a formal agenda developed by the leader.

The students are encouraged to go beyond the Industrial Arts laboratory into the other parts of the school as well as the community. The use of public and private research centers as well as institutions of higher education is encouraged.

Throughout all of this procedure the focus is upon the application of technology to major problems facing mankind.

A fourth strategy that is usually found to a certain degree in the first three as previously discussed involves increased *interaction with the community*.

This fourth category could appear as an independent procedure which would lead to direct study and involvement with a wide range of community projects, activities, and studies. The students would get first-hand experiences on conservation projects, pollution control projects or commissions, urban planning projects, transportation studies, and many more.

Just as there have been varied forms of cooperative work experience programs in vocational education, this is a coopera-

tive work experience program in the area of man's pressing problems. The classroom for the student would actually be out in the real world dealing with the elements of real problems about which the voting citizen must ultimately make decisions.

### Instructional Materials

A problem anticipated in the development of the program was the availability of literature and information for such a futuristic kind of study.

Two days of study and exploration by a group of twenty students uncovered endless quantities of rich and useful information. There is actually no shortage of information on the problem areas identified for study.

A great deal of work, much of which is unknown to the average person, is being done in all of the areas. It also is apparent that the information is available in most instances where there is the drive to get it. Several hundred pieces of literature were collected and cataloged as a result of a student mail inquiry conducted with private industry and governmental units. The telephone approach also has netted a good return on appropriate materials.

There are a number of fine books on the market that deal with the application of technology and the problems facing mankind. However, it must be emphasized that this *is not a textbook program*, for it is doubtful if any text would be capable of covering the topics, to say nothing about keeping up-to-date with the daily changes in technological potential.

The types of materials include paperback books, movies, television and radio specials, research and development reports, pamphlets, brochures, newsletters, commission reports, legislative hearing reports, selected periodicals and many other forms of literature.

Another category of instructional materials relates to those that are found as a part of the community involvement strategy. It is here where the student gains access to the data and information gathered by a functioning organization as it attacks a particular problem.

The materials that relate to constructional or developmental activities are likewise available, although they may deviate

from the usual wood, metal, and paper commonly stored in the Industrial Arts laboratory.

The instructional materials deviate sharply from the usual instructional materials just as this program deviates from previous programs. This is to be expected in an education program that attempts to establish a high degree of relevancy in a society that has no parallel in the long history of man and his civilization.

The kinds of materials and the sources of materials are different, but they are available. This fact alone provides a great opportunity to break the lock-step textbook type of instruction, and it opens wide the opportunity for exploration, inquiry, and resourcefulness on the part of the student.

### **Facilities Required**

This senior high school program functions best in a comprehensive general shop. The nature of activities which may call for almost any type of construction, forming or fabricating makes it imperative that the laboratory be built to handle them. The following are some specific recommendations when developing a laboratory for the program.

1. Aside from the broad general laboratory facilities there should be a substantial electricity-electronics component or area.
2. Chemical and physical testing capability should be built into the facility.
3. An auxiliary seminar room is a requirement. This room should contain extensive media capability such as computer terminals, television, telephone, projection equipment of all forms, and audio recording.
4. Storage facilities should be more diverse than normal with the capability for temperature and humidity control as well as the potential for storing a wide range of materials.
5. High heat as well as low temperature producing equipment should be a part of the facilities.
6. The full range of physical facilities such as gas, air, electricity (AC and DC), exhaust systems, hot and cold water, and dust collecting systems should be a part of the specifications.

7. An extensive planning center should be included. There also should be adequate storage for reference books, magazines, bulletins, and other forms of literature.
8. An ideal facility would include four to six study carrels appropriately equipped for independent study and investigation activities.
9. A sizable project assembly area for group projects would be most desirable.
10. Display and exhibit spaces with adequate lighting and enclosure should be appropriately located within the laboratory.

The normal guidelines for acoustical, temperature, and ventilation control should be built into the plant. The floor surfaces should be appropriate for the kind of activity carried on in a particular part of the laboratory.

The physical facilities and the room design should permit a great deal of interchangeability in equipment and activities. This quality would also necessitate storage facilities capable of holding several pieces of equipment that would be moved in and out of the laboratory depending upon the particular activity or needs of the students.

### **Program Evaluation**

The evaluation of a program ranges from the simple to the complex depending upon the nature of the activity. Needless to say, this is a complex program with many and varied activities aimed at broad and far-reaching objectives.

The ultimate goals of the program are directed towards:

1. The development of understandings compatible with the needs of a citizen who must make decisions regarding the application of technology in the solution of major problems facing mankind.
2. The development of "process skills" (inquiring, problem solving, relating, etc.) consistent with the needs of an individual in a changing society.
3. The exploration of the "self" so that each individual may attain an estimate of his capabilities, interests, aptitudes, likes, dislikes, compatibilities, and other personal attributes.

4. The development of individuals concerned about the needs of mankind and a sensitivity towards personal involvement in working towards the satisfying of such needs.
5. The development of a positive attitude towards change in a society characterized by accelerating change.

As one examines each of the above broad and complex goals it is apparent that no single or simple system would suffice.

Suggested forms of evaluation are as follows:

1. The process goals for the most part may be approached through the *technique of observation* using appropriate *behavioral goal* statements and assessing their attainment.
2. The goals related to understanding and decision making regarding the application of technology can be approached through the use of *objective tests* as well as *observation techniques*.
3. The self-exploration goals with their individual characteristics can be approached through *pre* and *post objective tests*, and through the *techniques of observation and anecdotal recordings*.
4. The goals dealing with "concerned" and "involved" aspects of the individual's development may be approached through objective tests on a pre and post basis to determine the impact of the program. Also the *observation and anecdotal record* procedures have considerable value for this goal.
5. The "attitude towards change" can be examined and assessed through the use of *objective test* procedures, and to some extent through *teacher observations* of the individual in various situations.

Immediately, some will be inclined to indicate that these evaluation procedures are too involved and difficult. Yes, it is considerably different than counting pages, measuring the length and width of objects, or assessing the smoothness of a finish.

The requirements of man become more complex year by year, and the appropriate form of education likewise must reflect this increasing complexity. It also should be noted that the suggested forms of evaluation relate to the *performance, accomplishment, or change in the individual* as such elements

*relate* to the goals of the program. This is in itself a complex task.

However, there has been another form of evaluation applied to this educational experience. A group of advanced students were put through a practicum dealing with the program. The activities of this group paralleled the kinds and range of activities associated with the program as conducted at the senior high school level.

At the conclusion of the experience the teachers were asked to rate the program on how well it measured up to a series of statements describing advocated characteristics of educational programs that were developed in the decade 1960-1969.

This listing of qualities, or descriptives was taken from an article written by Dr. John Goodlad which appeared in the April 1969 issue of the *Saturday Review*, and contains the following points:

*First*, teaching would be characterized by efforts to determine where the student is at the outset of instruction, to diagnose his attainments and problems, and to base subsequent instruction on the results of this diagnosis. *Second*, learning would be directed toward "learning how to learn," toward self-sustaining inquiry rather than the memorization and regurgitation of facts. *Third*, this inquiry would carry the student out of confining classrooms and into direct observation of physical and human phenomena. *Fourth*, classrooms would be characterized by a wide variety of learning materials—records, tapes, models, programmed materials, film strips, pamphlets, and television—and would not be dominated by textbooks. *Fifth*, attention to and concern for the individual and individual differences would show through clearly in assignments, class discussions, use of materials, grouping practices, and evaluation. *Sixth*, teachers would understand and use such learning principles as reinforcement, motivation, and transfer of training. *Seventh*, visitors would see vigorous, often heated, small and large group discussions, with the teacher in the background rather than the forefront. *Eighth*, one would find rather flexible school environments—marked by little attention to grade levels—and extensive use of team-teaching activities involving groups of teachers, older pupils, parents, and other persons in the teaching-learning process . . . (p. 60)

The students in the class rated the program consistently high on most of the statements in the Goodlad article.

The essence of this aspect of evaluation is simply that educators and designers of programs must constantly keep in step with the best and most acceptable curriculum trends of the period in which the program is to function.

## BEHAVIORAL OUTCOMES

This last section of the report deals with some of the expected outcomes of the program. No attempt will be made to detail all of the "behaviors" that pertain to the several kinds and forms of outcomes. The presentation deals with the different categories of outcomes such as those associated with what one might identify as the "hard" content. These are the factual, problem development kinds of information so infinitely important if any meaningful effort is to be attempted. The second category of outcomes will deal with the "process" kinds of goals which through their accomplishment contribute significantly to the functioning of the individual in many aspects of daily living. The third kind of outcomes dealt with in this section are more general and are directed towards the societal impact of the program.

The first and basic set of outcomes deals with those elements that contribute to the background of the program as well as generate the need and substance around which the study is conducted. This is the "hard" content. It is expected that the student would develop considerable understanding and background with respect to the following topical headings:

1. The nature and extent of selected problems facing mankind (with special reference to transportation, power generation, trash and waste disposal, communications, housing, pollution, resource utilization, and water development).
2. Elements contributing to the nature and extent of the problem.
3. How the problem differs in various areas.
4. Projected solutions of the problem.
5. Alternative solutions to the problem.
6. Technological developments and advances associated with the solutions.
7. Projected societal impacts of the solutions.

Another set of outcomes may be identified in the "process" form of student involvement through an appropriate compilation of statements relating to students activities in problem solving, inquiring, exploring, challenging, evaluating, constructing, designing, communicating, leading, following, and interacting with others.

Another way of looking at behavioral outcomes could take the position that the program would lead to:

1. A *concern* for the trend and direction of society.
2. An *awareness* of the alternatives available to man in his search for solutions to selected major problems.
3. Active *involvement in exploring* the solutions to selected societal problems.
4. An *awareness* of the accelerating technology and a readiness for change.
5. An *awareness* of occupational opportunities associated with the increased application of technology in the solution of selected major problems.
6. A more effective *use* of the tools and materials of industry in a new and dynamic encounter with society.
7. The *application* of one's ingenuity, ability, and potential in meaningful and relevant activities dealing with man's pressing problems.
8. The ability to *function* as a contributing member of a team, group, or as an individual.
9. An increased ability to *use* the expanded resources of the community in the process of "learning to learn."

The matter of behavioral outcomes takes on many forms dealing with long- and short-range goals as well as one's personal outlook. Involvement of the student in the examination of such problems, the study of alternate solutions, and the identification of future problems could have profound effects upon the individual and the future. Some of these projected effects are as follows:

1. The voting public (decision makers) of the future would have a sensitivity to the kind, nature, and extent of such problems facing mankind.
2. The individual would have some understanding of and sensitivity to the nature of solutions and the alternatives related to the problem.
3. The strength of the student's adult participation in dealing with such problems would be greatly enhanced by his earlier involvement in real and direct experiences related to them.

4. The student through appropriate kinds and levels of involvement would begin to feel he is a part of the system and that he does have a role to play.
5. The student's communication with his or her parents and other adults on the concerns and activities of the program would have the potential for even wider levels of involvement.

The outcomes as presented in this brief presentation range across the various components of the "hard" content. There is another form of outcomes that deal with the "process" forms of student involvement, and also, there are the objectives or outcomes that relate to the development of the individual.

This is a program that has great potential for the development of the individual while at the same time contributing to his effectiveness as a decision maker in a rapidly changing society plagued with problems that must depend more and more on technology for their solution. Finally, it is a program that would function to reduce the gap of technological ignorance that separates the technologist from the remaining elements of society. This latter idea is very important if democracy is to survive in a society so greatly influenced by technology.

### BIBLIOGRAPHY

- Bernardo, James V., "Educational Implications of the Space Program," *Apogee* 67. May 1967, (Published quarterly by the Douglass Aircraft Company).
- Bruner, Jerome, "The Skill of Relevance or the Relevance of Skill." *Saturday Review*, April 18, 1970.
- Fabun, Don, *The Dynamics of Change*. Englewood Cliffs: Prentice-Hall, Inc., 1968.
- Foshay, Arthur W., "How Fare the Disciplines?" *Phi Delta Kappan*, Vol. LI, No. 7, (March 1970).
- Goodlad, John I., "The Educational Program to 1980 and Beyond," *Implications for Education of Prospective Changes in Society*, E. L. Morphet and C. O. Ryan, editors. New York: Citation Press, 1967, p. 57.
- Goodlad, John I., "The Schools vs. Education." *Saturday Review*, April 19, 1969.
- Rubin, Louis H., "The Object of Schooling: An Evolutionary View," *Life Skills in School and Society*, ASCD Yearbook. Washington, D.C.: National Education Association, 1969.
- Wilhelms, Fred T., "Which Way to a Curriculum for Adolescents." *NEA Journal*, (December, 1967).

SECTION VII

**Assessment of  
Industrial Arts Programs in the  
American Public High School**

# A Social Critique of Industrial Arts Education

*Lawrence S. Berlin*  
*Assistant Professor of Education*  
*School of Education*  
*and*  
*Director of Course Programs*  
*Extension Service*  
*The University of Michigan*

"They are a hell of a lot smarter."

"They are better educated."

"I figure there are four in any ten of them with any desire to learn the job. The rest are here to do as little as possible."

"They don't give a damn. Watch 'em float around here, back and forth. I have to chase 'em to get any work done."

"They don't have a great fear of management as we had."

"Other generations didn't express themselves; this one does."

"You don't dictate to these people. Today you have to do more asking and suggesting and it sure takes time."

"The new work force presents supervision with problems they didn't know existed as little as five years ago."

"Because of low seniority many are at the bottom of the pay scale and have a tough time making ends meet." (1)

This is the reality of the world of work and it is into this kind of occupational environment that young people and young adults are thrust. Are they ready; ready emotionally and psychologically as well as vocationally and technically?

Preparation for the world of work has been viewed throughout the twentieth century in this country as a unique responsibility

of the secondary schools—especially the public schools. We have uncritically embraced the notion that a comprehensive curriculum in the setting of a multi-purpose secondary school is a necessary and sufficient condition for bringing students to a level of readiness which will enable them to easily and successfully step into an autonomous adult economic role. Elaborate networks of program and institutional design coupled with an infinite number of school-community interactions serve to reinforce the view that effective preparation for work is occurring. Failures in preparation are viewed not as a function of systematic dislocations but instead are attributed to the inadequacies or disabilities of individual students.

If we are uncertain as to the level and quality of readiness of students to enter the world of work, can we be any more certain about the efficaciousness of our central institutional base to provide the foundation for the economic capacities of its charges?

I raise these questions at the outset for I believe that any critique of industrial arts education must address itself to certain large and basic issues present at this time in our culture. Schools do not exist apart from the rest of society; they are part of that society, shaped largely by the very culture they purport to serve. A strong case can be made to suggest that in fact schools, and in particular industrial arts education, are the captives of a powerful set of forces operating in the larger culture; forces which may often be contrary to the very aims and rationales which schools have historically claimed as appropriately their own. (2) An examination of American secondary education from this perspective will juxtapose an interpretation that varies considerably from that which is suggested by the contributors to this yearbook.

We develop our conceptual and intellectual models consistent with and closely conforming to our basic value system. We are committed to mass democratic public education; committed to concepts of educational opportunity; committed to the value of human dignity and individuality and committed to improve the quality of life for all citizens. But none of these pretty but rhetorical beliefs tell us very much about the reality of school and work; nor do they speak to the harsh issues of economic survival and personal identity in an increasingly complex, troubled and confused society.

What then do the contributors tell us and, more significantly, what have they not told us about the secondary school and industrial arts education?

### THE CULTURE OF THE SCHOOLS

What is Milgrim High like? It is a big, expensive building, on spacious but barren grounds. Every door is at the end of a corridor; there is no reception area, no public space in which one can adjust to the transition from the outside world. Between class periods the corridors are tumultuously crowded; during them they are empty; but they are always guarded with teachers and students on patrol duty. Patrol duty does not consist primarily in the policing of congested throngs of moving students, though it includes this, or the guarding of property from damage. Its principal function is the checking of corridor passes . . . . A student caught in the corridor without such a pass is taken to the office where a detention slip is made out against him, and he is required to remain at school for two or three hours after the close of the school day . . . . There is no physical freedom whatever at Milgrim. That is, there is no time at which, or place in which, a student may simply go about his business. Privacy is strictly forbidden . . . . Milgrim High's most memorable arrangements are its corridor passes and its Johns; they dominate social interaction. "Good morning, Mr. Smith," an attractive girl will say pleasantly to one of her teachers in the corridor. "Linda, do you have a pass to be in your locker after the bell rings?" is his greeting in reply. (3)

Edgar Friedenberg's description of a secondary school stands in stark contrast to Lester Anderson's review of the rise of secondary education in this century. No one can dispute the impressive quantitative achievement which Anderson outlines; the fact that today there are close to fifteen million young people enrolled and this enrollment represents ninety-five percent of the population between the ages of fourteen and seventeen are statistics of great significance. The creation of physical facilities to house these numbers and the creation of programs to serve large new populations attest to the energy the educational establishment has invested in meeting the phenomenon of universal secondary education. But hidden in this survey of the rise of secondary education and the attendant development of industrial arts education are such issues as the impulse toward educational uniformity and homogeneity, the absence of consideration of the school as a social institution and the failure to consider the relationship of schooling to the process of socialization. All of these forces are woven into the basic texture of the school ex-

perience and are central to an understanding of the current status of secondary education. Inherent in all of the essays is an unsettling orthodoxy of approach—the excellent descriptions of programs and curricula, the statement of municipal and state projects, the outlines of experimental proposals—all claim the same purposes and postulate generally similar theoretical justifications.

How can, for example, Ullery, Liebowitz and Berger argue for specialized program development when they, as Anderson, do not speak to the setting in which such programs must be carried out? Where in *Yearbook 22* do we find a discussion of the financial disarray of public education and its implications for industrial arts? Who has spoken to the desperate malaise of educational practice in urban settings? What questions have come forward on the vexing problems of race and ethnicity? Even such currently popular topical themes as the open classroom, informal education and independent learning, alternative schools, innovative education, decentralization and community control, deschooling and the abolition of compulsory education (granting that many of these notions and their most vigorous proponents are fantasy ridden) have escaped the attention of all of the contributors.

I am suggesting that almost without exception the contributors to this book have accepted the secondary school as we have known it in our historical experience as the *sine qua non* of the conceptual and organizational pattern for delivery of educational services to the young. We need only to examine Callahan's study of the efficiency movement of the Twenties to learn what a singular and uncritical acceptance of a given intellectual formulation can lead to. (4)

Let me outline some areas that industrial arts educators need to examine if they expect to sustain an effective and valuable experience for young people.

Implicit in all of the essays is the notion that school and schooling are a "good" thing—programmatically formulations are developed on sets of assumptions which may not meet the test of validity in the setting of reality. For example, do we know that because more youngsters are enrolled in school they are necessarily more effectively or better educated? Can we say with assurance that because the drop-out rate has declined dramati-

cally that those who stay are learning—you don't have to leave school in order to drop out. Industrial arts education asserts that its central goal is the achievement of work literacy, yet we see increasing evidence of a decline in functional and cultural literacy within the total school population, and these are attributes which precede work literacy and are basic to anyone who expects to function successfully in the world of work. (5)

The significant factor to be examined is the place of the student in the school setting. Historically educators have tended to view the student as a passive actor in the process of education—each new generation of young people represented Locke's *tabula rasa*, an empty bottle into which the system would pour its medicine. Only recently has widespread serious attention been given to alternative propositions, e.g., that learning transcends merely mechanistic processes, that rote learning may in fact be no learning, that the context of learning is infinitely more complex than we were willing to acknowledge, and that perhaps the medicine of our educational history was compounded by alchemists.

Do all of the elaborate structures of curriculum design, rationalized strategies of instruction, complex terminologies of performance objectives and elegant measures for evaluation take into account the value system and behavioral patterns of students? Can matrices and comprehensiveness of educational plans overcome the serendipitous quality of life? Will even the most carefully designed field experience (which students invariably recognize as "going to school") profoundly affect peer learning and interactions? Where in all of the elaborate schemes of industrial arts and career education is there an expressed concern for the anomic quality of student life? Of all areas of secondary education it is in industrial arts that closest attention should be given to the growing disengagement of the student from the very process of schooling for the anomic quality of the student experience continues into their occupational experiences and is a significant factor in the severe economic and social dislocations we observe in our industrial society. (6)

The preceding analyses suggest that industrial arts education is confronted by an especially profound and exciting challenge, for it is in industrial arts, as in science education, that the potential for engaging students in an active and vital learn-

ing experience is greatest. The English call it practical education. Unhappily we hide our central purposes under euphemistic phrases such as career education, preparation for life, vocational learning, preparation for careers and the like. (7) The fact of the matter is that industrial arts is engaged primarily in practical education and is therefore planted firmly in the tradition of John Dewey. This tradition calls for cognitive and affective engagement of both student and teacher throughout the curriculum—a process which is especially congenial to the purposes of the industrial arts curriculum.

The discussions of Lux and Ray, Yoho, Pine, Maley, Mitchell, and Olson are either suggestive of or derivative from the formulations of Dewey. What I find missing is a sense of rigor in their collective sets of arguments and an absence of clarity on critical issues I have identified previously. For example, Olson is concerned about the question of the creditability and image of industrial arts—a laudable goal but what about the creditability of the product of industrial arts? Pine's thesis suggests that the objectives of industrial arts (whether homogenized or not) are a function of the needs of industrial capitalism. Without belaboring the important question of whether education should be viewed as a servant of the economic order, it should be noted that nowhere in Pine's extensive essay does there appear a single reference to the powerful and pervasive force of organized labor. Yet the union movement has at least as much influence on the outcomes of industrial arts education as does any of its curricular and pedagogical designs.

L. W. Yoho's central proposition is the most troubling of any to be found in *Yearbook 22*; "The Orchestrated Systems Approach treats individuals as components of systems . . ." Despite the fact that this assertion is qualified somewhat in its total context, its implication cannot be ignored. Individuals are "components"—what can we expect from a curriculum and an educational experience that deals with components rather than with aspirations and disappointments, strengths and frailties, laughter and tears, public enthusiasm and private agony—in short, the totality of the student as a human being.

The question of rigor and clarity ultimately turns on how the student is viewed in relation to the particular curricular invention devised for him. These inventions cannot be abstractions

for their legitimacy and utility will flow from the measured success of their effect on students. We need to maintain a stance toward students that comprehends the great diversity of individuals as well as the diversity of settings from which students come. And at the same time we need to understand the dynamics which determine individual diversities and have some insight into what the diversity of settings contributes to the shaping of individual character and personality. The absence of discussion about the socialization process, adolescent values, peer relations, questions of self-esteem and similar issues does not lessen their importance for industrial arts education. (8) It is through an explanation of these issues that a realistic view of the world of the student can be gained and this in turn converted into the process of preparing for work within the larger context of contemporary culture.

### THE CULTURE OF WORK

The women of the phone company are middle class or lower middle class, come from a variety of ethnic backgrounds (Polish, Jewish, Italian, Irish, Black, Puerto Rican), mainly high school graduates or with a limited college education. . . . Their leisure time is filled, first of all, with the discussion of objects. Talk of shopping is endless, as is the pursuit of it in lunch hours, after work, and on days off. The women have a fixation on brand names, and describe every object that way. . . . They are especially fascinated by wigs. Most women have several wigs and are in some cases unrecognizable from day to day, creating the effect of a continually changing work force. The essence of wiggery is escapism: the kaleidoscopic transformation of oneself while everything else remains the same. Anyone who has ever worn a wig knows the embarrassing truth: it is transforming. (9)

The transition from late adolescence to early adulthood is painful and is rarely made easier by the experience of formal schooling. Adding to this pain is the initial shock of confronting the world of work—a world that rarely conforms to images that young people have of employment and wage earning. To be more specific, the thrust of most vocational schooling leads students to expect work to be part of life, to view their role as wage earner as an inevitable and integral part of their person. Education for jobs is grounded on a precept that work has meaning, value and utility—in short, to be work literate means that one will be a self-sufficient, productive, contributing member of society.

Throughout the essays in *Yearbook 22* we find formulations such as “develop an understanding of industry and technology . . . . develop skill in use of industrial tools . . . . develop desirable attitudes toward work . . . .” (Mitchell) or “industrial arts is an element of the educational program which provides the essentials for enlightened citizenship” (Lux and Ray) and “it is a program that would function to reduce the gap of technological ignorance that separates the technologist from the remaining elements of society” (Maley). These are all unimpeachable educational rationales but do they have validity when examined under the harsh light of contemporary employment and industrial practice? Where, for example, will a student confront in a meaningful way the tediousness and excruciating boredom of a swiftly moving assembly line; how will a learner be made to understand that natural ambition and a desire to do excellent work are frequently at the mercy of the “system” or organizational constraints or union rules; who can describe the agony of marginal employment or underemployment in terms that have meaning for young people? (10)

The foregoing observations suggest that industrial arts education must increasingly focus its efforts on explications of the real and the concrete. Our educational system overtrains its products, creates false expectations for employment opportunities and provides precious little equipment to the student which will enable him to psychologically survive the day-to-day ritual of employment. The myth of a necessary relationship between educational achievement and job performance has been shattered by recent investigations. The fact that educators and employers continue to act on the folklore of the past makes the task of creating reality-bound industrial arts programs even more difficult. (11)

Coupled with the fact that we overtrain most students for entry level jobs is the infatuation of our educational system with the American mania for credentials. S. M. Miller makes the point with great force:

It is assumed that these credentialing procedures assure a better product—that those who receive the credentials can do much better in the occupation than those who do not; that those who successfully go through the steps needed to gain the credentials are better fitted for the occupation than those who are not interested in doing so or fail in the prescribed climb.

I submit that we do not know if these two assumptions are true. To some extent they are undoubtedly untrue. And a broader assumption—that those who do not go through credentialing activities are unfit for the demands of the occupation—is clearly inaccurate . . . .

Schools today are not a humanizing or an educational force as much as a credentialing agency, sorting people out who do not fit into the regular channels of educational development. Schools function to certify that someone is not harmful rather than to develop the potential of all. Many of the poverty and job-training programs serve the same function. (12)

Until we acknowledge in the construction of industrial arts programs and in our comprehension of the social context of work that the world is not fully rationale and that the applications of technology are not completely a function of scientific judgment, we will continue to be trapped by the conventions of traditional practice. These conventions place a premium on such devices as standard tests for abilities related to vocations, high verbal skills as proof of potential job performance, acceptable personal characteristics as proof of a capacity to “get along” in a work setting.

The impact of credentials can most readily be observed in the rhetoric that accompanies the arguments for remaining in school. Potential drop-outs are urged to remain because the diploma (credential) will enhance their total lifetime income—schools preach this and employers practice it. But does the credential matter all that much? A seventeen year old drop-out for whom education has failed may viscerally know better. He heads for the assembly line and gets a leg up on the seniority system and shortly thereafter his peers with the credential in hand are working next to him—but they are relatively disadvantaged because of the absence of time on the job.

Some comments are in order about the quality and conditions of work in contemporary society. Much has been written about the phenomenon of alienation in modern society and its impact on workers and work settings. (13) Workers are described as brutalized or dehumanized at worst or unfulfilled and frustrated at best. Industrial arts education cannot be held responsible for this universal condition but it can attempt to formulate its curriculum to increase the student's awareness of and capacity to combat these forces. We are witnessing an intensification of the tendency to separate work from the rest of life—a tendency which is the antithesis of the value system of industrial arts. On this point I find the authors of *Yearbook 22* in essential agreement and hap-

pily so for the need to integrate the creative dimensions of work with the essential humanity of a person's life is one of the central imperatives of our time.

Most of the curricular designs in industrial arts education suffer from a surfeit of ethnocentric assumptions—students are more alike than they are dissimilar, questions of social class are not relevant to an understanding of work and, more significantly, deviant attitudes toward work have no place in the curriculum. We need only to look at recent events such as the General Motors-United Auto Workers conflict at Lordstown, Ohio, or the struggle for control of the United Mine Workers to realize that the reality of work is played out in ways never anticipated or planned for in an organized school curriculum. While I do not believe that "school" can ever be a perfect surrogate for the real world, the infusion of materials and experiences that are contrary to the traditional middle class work ethic will provide illuminating perspectives that can help students prepare for work. (14) It is the student, transformed into worker, who will ultimately be confronted with the tensions of class difference and divergent value systems as part of his daily existence as economic man.

### THE CULTURE OF TECHNOLOGY

Those who cannot remember the past are condemned to repeat it.

Santayana

Beware of fiat disguised as technical necessity.

Robert J. Blakely

The redemption of the modern age will be achieved through the benign presence of technology—this is the message we receive from the technocrats and the futurists. Like the larger culture, educators have come to accept a culturally determined value as a central organizing principle for their organizational and behavioral standards. The principle is technology and it is applied with vengeance to all of the formulations of contemporary industrial arts programs. The orthodoxy of program design and conceptual rationales which I noted earlier are nowhere more evident than in the way in which industrial arts curricula propose to deal with the "technology question." Should education of the young be entrusted to a set of assumptions that reject ambiguities and an organizational scheme that is convinced of the certainty of its purposes?

Is the landscape of the modern age and its central feature, technology, as finite and clearly observable as we would like or are led to believe? (15) Paul W. DeVore's excellent piece would suggest otherwise. As DeVore's argument unfolds we begin to see the complexities and ambiguities surrounding the "technology question." These complexities and ambiguities are primarily a function of socio-cultural response to technology, yet the tendency is to ascribe them to technology itself. To accept DeVore's notion that the distinguishing feature of technology in our culture is its dominance is to overlook the fact that all historical societies have had a value which was dominant and pervasive—the Church in the early Middle Ages, the crown in Elizabethan England. Our age has elected technology as its secular god.

But the presence of a dominating force in a culture suggests the need for a healthy skepticism directed at its presence. Casual notions suggesting that the harnessing of technology for the greater public good, or that we can educate a large public to understand and utilize technology, or, as DeVore suggests, some form of participatory control and involvement in technology is feasible, all overlook some of the most salient features of technology.

Technology is foremost a powerful abstraction. Definitions of technology almost invariably lack specificity—the concept has a quality that transcends the real and the concrete, it stands apart and at a far distance from the familiar and shared experiences of most people. Along with its quality of abstractness, technology may be described as having an existence separate from the culture which it is said to dominate. In this respect it is very much like modern bureaucracy, which is also a powerful abstraction, which leads a life independent from the uses to which it is put. (There are some fascinating parallels between the rise of bureaucracies and the rise of the modern concept of technology.) The abstract and independent qualities of technology are closely associated with another of its principle characteristics—elitism. Because technology relies heavily on scientific-mathematical models and formulations for its language, access is limited to a privileged few and it will always be this way. (16)

The qualities of abstractness, independence, and elitism which are so profoundly unique to technology represent a vital challenge to industrial arts educators. I see no easy or direct way to

overcome them. The curricula so extensively described in this book may very well teach the interrelatedness of a specific technology to another but does that make "technology" any less abstract or more accessible or lessen the hold of the priests of the language, I think not. If participatory democracy, which was required by statute and sanctioned by considerable moral force throughout the 1960's could not budge the bureaucracies (including school bureaucracies), should we expect more from the same concept when applied to technology?

DeVore calls for new choices and more options—these to be achieved through the study of technology and social systems. He is much more sanguine than I about the prospects of any educational reform, organizational or curricular, achieving so ambitious an outcome as a broad understanding of or critical influence on the "technology question." (17) Certainly an industrial arts program must be sensitive to larger social issues in our culture and must be cognizant of the need to sensitize students to the significance of these issues.

It would be a mistake, however, to invest in the study of technology such effort that the critical reality dimension of the student's experience suffers. This is not to suggest a Luddite's position on the question of education for technology but rather to suggest that what is paramount is that the student know who he is and what he is. What we should hope for and look for and work for in all students is a trained intelligence, an inquiring mind, and the capacity to cope with the real world.

#### FOOTNOTES

1. Quoted in Robert Schrank "The Young Workers: Their Influence on the Workplace," *The Urban Review*, Vol. 5/6, June 1972, p. 12.
2. For example see Joel H. Spring, *Education and the Rise of the Corporate State*, Beacon, 1972; Colin Greer, *The Great School Legend*, Basic Books, 1971; Arthur C. Wirth, *Education in the Technological Society: The Vocational-Liberal Studies Controversy in the Early Twentieth Century*, In text Educational Publishers, 1972; Harry S. Broudy, *The Real World of the Public Schools*, Harcourt, Brace and Jovanovich, 1972. For a social-cultural perspective see Jules Henry, *Culture Against Man*, Vintage, 1963. Lawrence Cremin in *The Transformation of the School*, Knopf, 1961; and Solon Kimball and James E. McClellan in *Education and the New America*, Random House, 1962, provide especially valuable accounts and analyses of the historical and philosophical foundations of Twentieth Century American education. Two recent works

- by Michael B. Katz provide rich insights into the relationships of school and society and carefully document the extent to which schools are resistant to change: *The Irony of Early School Reform—Educational Innovation in Mid-Nineteenth Century Massachusetts*, Beacon, 1968, and *Class, Bureaucracy, and Schools: The Illusion of Educational Change in America*, Praeger, 1971.
3. Edgar Z. Friedenberg, *Coming of Age in America*, Vintage Books, 1967, pp. 28-29.
  4. Raymond E. Callahan, *Education and the Cult of Efficiency*, Chicago, 1962.
  5. The complexities and problems of literacy and drop-outs are well illustrated by Robert A. Dentler and Mary Ellen Warshauer, *Big City Drop-outs and Illiterates*, New York, Center for Urban Education, 1965. Another formulation of literacy, as an active political-social phenomenon, can be found in Paulo Freire, "The Adult Literacy Process as Cultural Action for Freedom" and "Cultural Action and Conscientization," *Harvard Educational Review*, Vol. 40, Nos. 2 and 3, May and August 1970. See also Manfred Stanley, "Literacy: The Crisis of a Conventional Wisdom," *School Review*, Vol. 80, No. 3, May 1972.
  6. The alienated student is rarely seen as a particular sociological problem in the school, however the phenomenon is more widespread than we acknowledge. For a description and assessment see Friedenberg (item 3 above) as well as Carl Nordstrom, et. al., *Society's Children: A Study of Ressentiment in the Secondary School*, Random House, 1967. Contemporary autobiographical statements by young people frequently reveal the high incidence of estrangement from the process of schooling. One of the best examples is Frank Conroy's *Stop Time*, Viking, 1965 and 1972.
  7. A recent coherent, brief statement from the British perspective can be found in Harold Entwistle, *Education, Work and Leisure*, Routledge & Kegan Paul, 1970. See also Michael Carter, *Into Work*, Pelican, 1966.
  8. Studies of adolescence abound. J. S. Coleman, *The Adolescent Society*, Free Press, 1971, is systematic and carefully done. The Fall 1971 issue of *Daedalus* contains a series of unusually stimulating essays entitled, "Twelve to Sixteen: Early Adolescence." The mood of adolescence can be felt in Thomas J. Cottle's *Times Children: Impressions of Youth*, Little, Brown, 1971. All of Robert Coles' works on children and youth evoke powerful images of the world of young people—see especially his three volumes, *Children of Crisis*, Little, Brown, 1967 and 1972.
  9. Elinor Langer, "The Women of the Telephone Company," in *The New York Review of Books*, Vol. 14, No. 6, March 26, 1970, pp. 14-16.
  10. For a recent account of the economic and social conditions of under-employment see Willing Spring, Bennett Harrison and Thomas Vietorisz, "Crisis of the Underemployed," *New York Times Magazine*, Nov. 5, 1972.
  11. The best work on the educational achievement—job performance issue is Ivar Berg, *Education and Jobs: The Great Training Robbery*, Beacon, 1971. Thomas I. Ribich in *Education and Poverty*, The Brookings In-

- stitution, 1968, seriously questions the value and utility of expanding education and training as a solution to poverty.
12. S. M. Miller, *Breaking the Credentials Barrier*, Ford Foundation Reprint, 1967.
  13. See Daniel Bell, *Work and Its Discontents*, Beacon, 1956, and most recently Harold L. Sheppard and Neal Q. Herrick, *Where Have All the Robots Gone?*, Free Press, 1972. Also Sebastian de Grazia, *Of Time, Work and Liesure*, Anchor Doubleday, 1964. For an extraordinary account of life in a service industry see Elinor Langer, "Inside the New York Telephone Company" and "The Women of the Telephone Company," *The New York Review of Books*, Vol. 14, Nos. 5 and 6, March 12 and 26, 1970. The forthcoming study on worker attitudes sponsored by the Department of Health, Education, and Welfare should be most useful in assessing the current situation.
  14. Suggestive possibilities include Elliot Liebow, *Tally's Corner*, Little, Brown, 1967; Gerald Suttles, *Social Order of the Slum*, Phoenix, 1970; Todd Gitlin and Nancy Hollander, *Uptown, Poor Whites in Chicago*, Harper Row, 1970.
  15. One of the most elegant and powerful statements on the work-alienation-modern condition theme is Hannah Arendt, *The Human Condition*, Phoenix, 1957 and 1970.
  16. Victor C. Ferkiss, *Technological Man: The Myth and the Reality*, Mentor, 1969, provides a sophisticated antidote to a simplistic adoration of technology. John McDermott's "Technology: The Opiate of the Intellectuals," *The New York Review of Books*, Vol. 8, No. 2, July 31, 1969, provides a corrective to the anti-democratic, elitist tendencies of technology. Donald Michael in *The Unprepared Society: Planning for a Precarious Future*, Harper, 1968, makes a balanced case for technology and for the need to differentiate short range and long range planning for the future—a point frequently overlooked by the more vigorous of the futurists.
  17. Two recent books suggest that we misplace our faith if we expect education to resolve fundamental social and political problems: Christopher Jancks, et. al., *Inequality: A Reassessment of the Effects of Family and Schooling in America*, Basic Books, 1972, and Murray Milner, Jr., *Illusion of Equality: The Effect of Education on Opportunity, Inequality and Social Conflict*, Jossey-Bass, 1972.

# A Critique of Eleven Papers Discussing Industrial Arts in the Senior High School

*Ron Edmonds  
Assistant Superintendent  
Michigan Department of Education  
Lansing, Michigan*

Having completed a review of eleven of the foregoing papers, presented by some of the leading decision makers and opinion makers in the field of industrial arts, I am pleased to note that reforms of substance and quality are being widely proposed and that the probable effect will be improvement in public instruction in general and in industrial arts in particular.

Insofar as the eleven writers represent industrial arts educators, certain notable characteristics emerged as I completed my review. There is an intense interest in the practical aspects of public instruction which seems to have its origin in the prevailing notion that industrial arts pupils, for the most part, represent that portion of the matriculating population that is least likely to pursue liberal arts higher education. Such a prevailing perception of the student body presumes the necessity to offer public instruction with intrinsic merit.

I infer that industrial arts educators consider college-bound pupils more internally motivated with respect to schooling and, therefore, less likely to respond to irrelevant and impractical instruction by quitting school.

Such a premise has at least two competing consequences. On the one hand, there is the inferred notion that the college bound are, and will remain, the principal decision makers and opinion makers of America's society—partly because they are more likely to finish school and partly because finishing school implies that they deserve their status. I reject that inference and hope that I am mistaken in my perception.

As I am more interested in the second consequence of these writers' concern for the non-college bound, I will turn straight-away to the second and more important point. Perceiving of a student body that must be "persuaded" to remain in school and believing that that persuasion must take the form of relevant and practical schooling gives the industrial arts educator a predisposition to critical examination of the relationship between instructional activity and student response to that activity. Such a perception, as reflected in these eleven papers, makes for a group of educators admirable in their commitment to students as opposed to courses.

I suspect that one of the principal dynamics of secondary school faculty discussion is this distinction between the industrial arts staff's awareness of the necessity and desirability of attracting and holding students while the traditional academic staff is more concerned with pedantic scholarship and the rudiments of intellectual respectability at the expense of pupil performance.

By and large, all of the papers advocate very substantial improvement in curriculum, materials, instructional strategies and the relationship between the activities undertaken and the pupil's response.

Gordon Liebowitz's "The Correlated Curriculum Program" and Lux and Ray's "An Upward Extension of the Industrial Arts Junior High Program" are especially noteworthy in their effort to effectuate thoroughgoing reform in industrial arts in response to the outstanding criticism that now characterizes schooling for the non-college bound. Jerry Olson's description of "Pittsburgh's Industrial Arts Program" is a model of appropriate direction and performance-oriented educational design.

These three discussions exemplify the virtue and the vice that now describes industrial arts educators. The virtue is that in each instance, careful and appropriate criticism is made of

the quality of instruction and the appropriateness of prevailing school practice as regards industrial arts departments. Every aspect of the program is carefully evaluated in the context of discerning appropriate improvement.

Each discussion then describes in some particularity the means by which improvement can be made in every aspect of the instructional activity. Such is the virtue of believing one's students must be held and recognizing that educational activities that cannot attract and hold students are probably inappropriate school practices.

The vice of industrial arts educators is revealed in two ways by these three discussions. First, each discussion offers a very nearly esoteric and pedantic rationale for improvement. It is as though the industrial arts educator feels compelled to use stereotypical techniques of the academician who bases programming on reasoning and intellect with little interest in probable pupil response to what is undertaken.

I suspect that this is partly based on the industrial arts educators' defensiveness in an institution dominated by pedants. That domination is inappropriate since the industrial arts educator is well equipped to lead all his colleagues to the truth that educational activities that are not devised in response to pupil performance are bound to come to grief.

It, therefore, causes me some distress that these men, with such a firm commitment to pupil performance, should dissipate their energies in esoteric and abstract discussion.

The second and final point in this regard is that once having determined the appropriateness of very substantial reform in course design, curriculum characteristics, materials utilization and instructional strategies, no suggestion is made that these reforms, as described, are appropriate to every student and to every educational activity that characterizes the public school.

I have two compelling reasons for recommending that the kinds of reforms described in these eleven papers be applied beyond industrial arts.

First, as I noted earlier, industrial arts educators are far more performance-oriented than their academic peers. Such leadership is long overdue in public instruction and might well serve to facilitate the kind of improvement we all seek.

Second, industrial arts educators are intensely interested in their relevance and therefore must be equally interested in their credibility with their students.

Most secondary students in public schools are well aware of the social stratification that now separates industrial arts from academic programs. I assume that industrial arts educators share my distaste for that social stratification.

To be effective, any reform directed to industrial arts students must be understood by the students as being appropriate and applicable to the entire student body. I recognize that, from a practical point of view, the reforms in these papers are far more likely to occur in the industrial arts programs than in other departments of the secondary schools. Even so, the reform that these papers represent, while being accepted initially only in the industrial arts, must be continually extolled as appropriate throughout the school system. Failing that, industrial arts students will see their instructors and principal advocates as parties to the continual separation of industrial arts and its students from the rest of the school. One of my principal criticisms, therefore, of all of these papers is the failure to apply all of the observations to all of the educational activities that now characterize public schooling.

As a final point in this regard, the history of efforts to change institutions makes it clear that the inertia of the larger body cannot be overcome by confining one's attention to a small and particularistic aspect of the life of the institution.

As a further general critique, I think it unfortunate that there is so little reference to accountability in these otherwise commendable papers. I have already noted that industrial arts educators are far more comfortable with the concept of measurable pupils performance than is usually the case with educators. That being so, industrial arts educators can be of inestimable value to the whole of public instruction by continually demonstrating the utility and appropriateness of accountability characterized by assured measurable pupil progress.

Two major changes are required in all of these discussions to affect such ends. First, these discussions should resist the temptation to articulate goals that are as broad, comprehensive and general as is usually the case when educational purpose is being discussed.

For example, Donald Maley's, "The Application of Technology in the Solution of Major Problems that Face Mankind in the Future," offers the following paragraph as a description of the goals of the program:

The ultimate goals of the program are directed towards: (1) the development of understandings compatible with the needs of a citizen who must make decisions regarding the application of technology in the solution of major problems facing mankind; (2) the development of 'process skills' (inquiring, problem solving, relating, etc.) consistent with the needs of an individual in a changing society; (3) the exploration of the 'self' so that each individual may attain an estimate of his capabilities, interests, aptitudes, likes, dislikes, compatibilities, and other personal attributes; (4) the development of individuals concerned about the needs of mankind and a sensitivity towards personal involvement in working towards the satisfying of such needs; and (5) the development of a positive attitude towards change in a society characterized by accelerating change.

Dr. Maley is not substantially dissimilar from his ten co-authors in the offering of such broad and comprehensive goals. I have two criticisms of such an approach to the goals of programs.

First, most public schools traditionally use such language to describe the purposes of the entire school system. Dr. Maley and his colleagues, in many important respects, deviate from the norm that describes prevailing educational practice. Much of Dr. Maley's initiative is lost when one discerns no basic disagreement between his goals and the goals of those who have presided historically over public instruction.

Second, and more important, to state such goals may be noncontroversial in the sense that few would disagree with them—but to state such goals is not useful in the sense that they cannot be measured. To offer goals that cannot be measured is to offer goals for which one need not be held responsible. The very essence of accountability is the willingness to be held responsible for what one undertakes.

Industrial arts will become a far more tactically effective instrument of educational reform if it will confine its statements of goals to those aspects of pupil performance that are observable and measurable.

A final point of general criticism of these discussions is a degree of inconsistency that characterizes all of them with the possible exception of Jerry Olson's, "Pittsburgh's Industrial

Arts Programs are Performance Oriented—Designed to Meet Students' Needs.”

Most of the papers propose content integration as one of the major characteristics in the reform of industrial arts. These suggestions make the point that except in those instances where industrial arts are providing specific job entry skills, the content of industrial arts should “break down artificial barriers between subject disciplines . . .”

The suggestion is made that the industrial arts teacher should design course content so that algebra is used in the solution of shop problems, history is used in the understanding of the technological society, economics is used in the understanding of production and distribution, etc.

These suggestions represent appropriate conceptual beginnings. They fall short because they fail to see that introducing academic course content into industrial instruction is too modest a reform to break down the barriers that separate the various disciplines.

These discussions are inconsistent to the extent that they persuasively criticize the failure of industrial arts to utilize other subject matter in instruction, but they do not reverse the criticism. None of these discussions is bold enough to suggest that the continued delineation of course content in any subject area is contrary to the context in which the students' knowledge and skills are to be used. Industrial arts educators, as represented by these discussions seem to understand that better than most of their academic colleagues. I, therefore, think that all subjects would profit if the same critical reasoning applied to industrial arts in these discussions was applied to the humanities and social studies.

I will close as I began, by complimenting the writers on substantive and appropriate proposals for reform in industrial arts. I urge the writers to expand their horizons and in the future to apply their discussion to the whole of the process of public schooling.

# Index

- Access to tools, 199-216
- Accountability, 23, 304
- Action, efficient, 236
- Activities, 117, 253, 273, 303
- Advanced placement, 61
- Advisory group, Pittsburgh, 178
- Affective domain, 191, 292
- Alienation, of man, 45, 204
- American Industries course, 223
- Applied arts, 233
- Applied learning, 237
- Applied technology, 266
- Area vocational centers, Maine, 130
- Area vocational concept, 65
- Articulation, Pittsburgh, 188
- Assembly programs, 105
- Attendance, New York City, 175
- Awareness, career, 84
  
- Behavior—
  - of student, 208
  - of technological systems, 291, 303
- Behavioral goals, 257
- Behavioral outcomes, Maryland Plan, 283
- Bureaucracy, and technology, 298
- Busing, 68
  
- Career clusters, 185
- Career decision-making, 86, 111
- Career development, 73, 222
- Career education, 30, 71, 74, 102, 112, 257
  - elements, 76
  - exploration, 172
  - and general education goals, 83
  - goals, Pittsburgh, 184
  - and industrial arts, 100, 110-119
  - interests, 99
- Career studies, development of, 84
- Careers, and education, 28
- CCEM (Comprehensive Career Education Model), 75
  - objectives, compared to industrial arts, 82
- Change—
  - and future, 212
  - influence of, 158
  - and shock, 24
  - of society, 261
- Citizenship, education for, 246
- Civil rights, 46
- Civilization, development of, 200
- Clusters, 78, 185, 230
- Cognitive competence, 191
- College attendance, non-academic students, 175
- College bound students, 58, 302
- Commerce, 88
- Commonalities in occupations, 111
- Communication, 88, 220, 225, 230
  - skills, 160
  - systems, 178
- Community resources, 118, 178, 277
- Competence, teachers', 191
- Competencies, 220
- Comprehensive general shop, 123
- Comprehensive high school, 58, 177
- Comprehensive program, 64
- Computers, and gifted, 166
- Conceptualization, in evaluation, 256
- Conflict, education and technology, 205
- Construction, 88, 100, 111, 221, 225, 232, 243, 249
  - in Maine Plan, 129
  - programs, 185
  - senior high courses in, 93

- Consumerism, 23, 257  
 Content—  
   of problem solving, 273  
   as reform, 306  
 Continuity, and education, 205  
 Contract, individual study, 168  
 Control, of technology, 209, 211  
 Controlling, 243  
 Cooperative education, 172, 179, 230  
 Correlated Curriculum Program,  
   170-176  
 Counselor, career, 173  
 Crafts, and technology, 202  
 Creativity, 143, 148  
 Credentials, 294  
 Crime, 48  
 Critique, 287-306  
 Culture, 35  
   nature of, 200  
   of schools, 289  
   technological, 217  
   and technology, 52, 296  
   of work, 293  
 Curriculum, 57, 59, 62, 238, 250  
   comprehensive continuum of, 124  
   cross disciplinary, 178  
   future, 219  
   Maine, 128  
 Curriculum designer, role of, 148  
  
 Decision making, 158, 262  
 Delphi technique, 164  
 Democracy, 20, 266, 284  
   and technology, 213, 298  
 Descriptive knowledge, 234  
 Design, 220  
 Development, 162  
 Developmental needs, 68  
 Developmental studies, 238  
 Diploma, role of, 295  
 Disadvantaged, 65, 156  
 Disciplines—  
   Aristotelian, 233  
   integration of, 306  
   of practical knowledge, 237  
 Dropouts, 29, 71, 73, 173, 291, 302  
 Drop-out rates, New York City, 175.  
 Drugs, 49  
  
 Ecology, 19, 23, 145  
 Economic opportunity, 18  
 Economic system, 99, 144  
 Education, 53  
   for career systems, 147  
   citizens participation, 22  
   competencies produced, 220  
   content of, 236  
   failures of, 30  
   forms of, 144  
   for future, 33  
   nature and change, 53, 214  
   problems, 20  
   purpose, 72, 218, 263  
   social stratification, 304  
   and technology, 52, 203  
 Electrical systems and servicing  
   technology, 252  
 Electricity-electronics, 98  
   in Maine Plan, 129  
 Empirics, 234  
 Energy, Maine Plan, 133  
 Engineering drafting course, 224  
 Engineers, and scientists, 32  
 Enrollment—  
   high school, 57  
   by curriculum, Ohio, 63  
   industrial arts in Pittsburgh, 184  
 Enterprise—  
   as environment, 152  
   history of economic, 147  
 Entry level jobs, 248, 295  
 Environment—  
   control of, 23, 39  
   for learning experiences, 151  
 Equality of opportunity, 42, 53, 67  
 Ergonomics, 144  
 Esthetics, 234  
 Ethics, 234  
 Evaluation, 164, 256, 282  
   of gifted students, 167  
   Maine Plan, 138  
   Maryland Plan, 280  
   Pittsburgh, 180  
 Exploration, 84, 111, 173, 179, 224  
  
 Facilities, 225, 289  
   IACP extension, 256  
   Maine Plan, 132  
   Maryland Plan, 274, 279  
   orchestrated systems, 152  
   Pittsburgh, 189  
 Fact-finding, 164  
 Famine, 37  
 Field trips, 102, 118  
 Finance, of education, 290  
 Followup study, New York City, 175  
 Food—  
   and population, 36  
   and poverty, 41  
 Foreign language, 62  
 Formal knowledge, 235  
  
 Gaming, 166  
 General education, 67, 83, 173, 236,  
   246  
 General shop, 122

- Geography, of poverty, 43  
 Georgia plan, 217-231  
 Ghetto, 46  
 Gifted student, meeting needs of,  
   156-169  
 Goals, 304  
   CCEM, 75  
   individual, 268  
   of industrial arts, 80  
   Maryland Plan evaluation, 281  
   Pittsburgh, 196  
   and reality, 294  
 Golden Age, 210  
 Goods, 78  
   division of, 243  
   production, 25, 88  
 Government, role of, 21  
 Graphic communication—  
   Maine Plan, 133  
   programs, 185  
 Group processes, use of, 118, 276  
 Growth and development, 257  
 Guidance, 194  
   from labor organizations, 105  
  
 Heroin, 50  
 High schools, 56-69  
 History, and cultural change, 36  
 Honors classes, 61  
 Human—  
   practices affecting, 144, 241  
   resources, 42  
 Human resources, as assets, 32  
 Humanities, 218, 233  
   status of, 27  
 Humanization, nature of, 143  
 Hunger, 38  
  
 IACP (Industrial Arts Curriculum  
   Project), 111  
   extension, 232-259  
 Imagination, 143  
 Individual—  
   differences, 61  
   role of, 292  
   study contract, 169  
 Individualization—  
   of education, 53  
   Maryland Plan, 268  
   Pittsburgh, 188  
 Industrial arts, 67  
   content areas, 123  
   curriculum options, 250  
   goals, 80  
   and orientation, 32  
   Pittsburgh goals, 181, 195  
 Industrial technology, 88, 217, 231,  
   238, 241  
  
 Industrialization, 21  
 Industry-education cooperation, 108  
 Industry—  
   focus of, 144  
   and industrial arts curricula, 34  
 Ingenuity, 143  
 Instruction—  
   materials, 255  
   organizing, 256  
   strategies for, 253, 275  
 Instructional materials, Maryland  
   Plan, 278  
 Instructional strategy,  
   orchestrated systems, 149  
 Integration, 68  
 Interdisciplinary approach,  
   Maryland Plan, 270  
 Interdisciplinary program, 170-176  
 Interests, using student, 268  
  
 Job entry, 248  
  
 Knowledge—  
   areas in school curriculum, 236  
   classifications of, 233  
   domains of, 234  
   growth of, 52  
   hierarchy, 233  
   of practice, 240  
   study of body, 246  
   technological, 202, 247  
   value of, 32  
 Labor force, Ohio, 63  
 Labor-industry-education coopera-  
   tion, 108  
 Labor, role in education, 105, 292  
 Lag, of education, 167, 206  
 Learning, 237  
   scope and goals in Pittsburgh, 192  
 Leisure, and education, 218  
 Liberal education, 246, 248  
 Life—  
   attitude toward, 210  
   and education, 53  
   quality of, 42  
 Loyalty, as goal and society need,  
   194  
  
 Machine, use of, 26  
 Maine Plan, 121  
 Malnutrition, 41  
 Man—  
   ecological concept of, 145  
   fulfillment, 142  
   his choices, 214  
   psychological deprivation, 44  
 Management objectives, Pittsburgh,  
   179

- Management practices, 241  
 Manual arts, 157  
 Manual training, 121, 219  
 Manufacturing, 88, 98, 100, 112, 185,  
     220, 225, 230, 232, 243, 249  
     in Maine Plan, 128  
 Maryland Plan, 260-285  
 Material goods, and industrial  
     technology, 218, 241  
 Material processing and  
     fabrication, 97, 252  
 Material utopia, 18  
 Materials—  
     in Maryland Plan, 278  
     practices affecting, 242  
 Mathematics, 62  
 Matrices—  
     IACP, 241-245  
     CCEM, 76  
 Meaning, realms of, 234  
 Measurement, for evaluation, 305  
 Mechanical systems and servicing  
     technology, 98, 212  
 Media, use of, 117  
 Mental health, and social discontent,  
     44  
 Methods, 135, 239  
 Minority groups, 46  
 Models—  
     career education, 87  
     Orchestrated systems, 149  
 Modular learning units, Pittsburgh,  
     185  
 Motivation, 143, 174, 301  
 Museums, as career education  
     resource, 106  
  
 National goals, 21  
 Natural resources, 89  
 Natural sciences, 233  
 Nature, of man, 142  
 Navigation technology, 201  
 Needs assessment process, 180  
 New York City correlated program,  
     170-176  
 Non-academic students, program for,  
     170-176  
  
 Objectives—  
     career education vs. industrial  
     arts, 81  
     of high school, 61  
     industrial arts junior high school,  
     221  
     Maine, 131  
     OVT in Pittsburgh, 178  
 Occupational industrial arts, 122  
 Occupational information, 111  
  
 Occupational preparation, 110  
 Occupations, categories of, 223  
 Operator, education for, 224  
 Opiates, 49  
 Opportunity, equality, 20, 67  
 Orchestrated system, 141-155  
 Organizing, 243  
 Orientation, 224  
     career, 173  
     vs. training, 31  
 Outline, of yearbook, 14  
 OVT (occupational, vocational,  
     technical) education—  
     compared with Industrial Arts, 183  
     Pittsburgh, 177-196  
  
 Parents' career studies, 104  
 Participation—  
     by citizens, 21  
     range of, 214  
 Participatory technology, 209  
 Peace, nature of, 44  
 Performance—  
     contract, 195  
     goals, 303  
 Perception, in learning, 193  
 Permissiveness, 22  
 Persecution, 43  
 Personal relevance, 263  
 Personnel practices, 244  
 Pittsburgh program, 177-197  
 Planning, 243-244  
 Pollution, 39  
 Poor, life of, 42  
 Population, growth and control, 36  
 Poverty, 40  
     nature of, 42  
 Power and transportation,  
     in Maine Plan, 129  
 Practical disciplines, 233, 292  
 Praxiological knowledge, 234, 235,  
     239  
 Prejudice, 45  
 Preparation, career, 84  
 Prescriptive knowledge, 235  
 Problem solving, 158, 162  
     as curriculum focus, 263  
     as curriculum strategy, 261, 271  
     issues facing man, 260  
 Process goals, Maryland Plan, 283  
 Processing, 243  
 Product management, 96  
 Production practices, 241  
 Production systems management, 97  
 Productive disciplines, 233  
 Professional societies, in career  
     education, 106  
 Profit, and human control, 153

- Progress, 210
  - measure of, 211
- Projects, 253
  - group, 268, 276
  - use of, 117
- Protection, civil, 47
- Psycho-motor competence, 158, 191
- Quadrant learning pattern, 150
- Race, and poverty, 43
- Racism, 45, 68
- Rationale, of yearbook, 13-15
- Reality, and school, 294
- Recreational expression, 257
- Relevancy, 24, 256, 262, 270, 302, 304
  - of college, 29
  - importance of, 143
- Research and development, 162, 220, 268
  - course, 224
  - ideas for student, 164
  - as strategy, 277
  - as teaching strategy, 161
  - technology, 251
- Resource unit, 124
- Resources—
  - managing, 40
  - use of, 38
- Respect, for individual, 192
- Role playing, 269
- Salable skills, 219
  - Pittsburgh, 188
- Scheduling, Pittsburgh, 184
- Schools—
  - challenge of technology, 51
  - problems facing, 290
  - reality of, 288
  - role in society, 288
  - and societal forces, 35-54
  - value of, 290
- Science, 218
  - and engineering, 33
  - emphasis on, 60
  - teaching of, 62
- Scientific Method, 143
- Scientific societies, in career education, 106
- Secondary schools, 56-69
- Segregation, 45
- Self-actualization, elements of, 76
- Self assessment, 111
- Self concept, 115, 289
- Seminars, student, 275
- Senses, use of, 116
- Sensitivity, to individuals, 193
- Serendipity, of life, 291
- Services, 78, 230
  - in Maine Plan, 129
  - in society, 25
- Sex, and poverty, 43
- Shock, future, 24
- Shop teacher, 59
- Simulation, 166
  - work experiences, 221
- Site management, 93
- Skills, 306
  - of human behavior, 219
  - Maryland Plan, 280, 283
  - of social process, 272
  - training, 74
  - of work place, 26
- Social problems, 233
  - in content strategy, 271
- Social psychological growth, 257
- Social purpose, 212
- Social relevance, 263
- Social sciences, 233
- Socialization, effect of schools, 68
- Societal forces, and schools, 35-54
- Society—
  - justice in, 20
  - pluralistic, 202
  - problems of, 263
  - school role in current issues, 68
  - and students, 31
- Special abilities, 116
- Special education, 224
- Spiral, career education as, 113
- Sputnik, influence on education, 60
- Staff participation, 114
- Staffing, differentiated, 62
- Status, of school subjects, 27
- Strategy—
  - of instruction, 253
  - instructional (Maine), 135
  - Maryland Plan, 275
- Strategy system models,
  - Orchestrated systems, 149
- Structure management, 95
- Structure production, 95
- Student clubs, for career education, 105
- Student planning, 115
- Students—
  - considerations of, 142, 302
  - and education, 22
  - gifted, 160
  - as individuals, 293
  - life of, 291
  - nature of high school, 57
  - place of, 291
  - and world of work, 287
- Symbolics, 234, 238
- Synnoetics, 234

- Synoptics, 234  
Systems—  
    education as, 292  
    technology and social, 213
- Talents, and education, 151  
Task forces, Pittsburgh, 180  
Teacher—  
    in Pittsburgh program, 189  
    role with gifted, 161  
Team teaching, 62  
    New York City, 172  
Technical high school, 60  
Technical report, 164  
Technological literacy, 257  
Technological societies,  
    in career education, 106  
Technology, 218  
    alienation from, 207  
    applied to problems, 260-285  
    cap and lower case, 207  
    characteristics, 201  
    culture of, 296  
    in culture, 201  
    cure for, 30  
    as discipline, 219  
    in education, 52, 62  
    generations of, 265  
    and industry, in society, 121  
    and knowledge, 51  
    pace of, 24  
    participatory, 18  
    and praxiology, 240  
    role in problem-solving, 264  
    support for, 202  
    as system, 240  
    as tool of expression, 204  
    use and control, 211  
    variable in society, 199  
    and work world, 221  
Themes, of Maine units, 126  
Theoretical disciplines, 233  
Theories, classes of, 234  
Third Industrial Revolution, 143  
Time, in OVT, 184  
Tools—  
    access to, 199-216  
    and choices, 211  
    and man's evolution, 217  
    and/of technology, 204, 208  
Trade training, 219  
Transportation, 88, 221  
    as problem, 271  
    programs, 185  
Trust, of teacher, 192
- Unemployment, 30  
Unit approach, 268  
    in Maine Plan (advanced), 124,  
    134, 135  
    Maryland Plan, 275  
    Pittsburgh, 185  
Unit plan guide, 127  
Urbanization, 25, 52  
Utilities installation and servicing, 96
- Value exemplars, 238  
Value—  
    of students, 291  
    of system elements, 145  
    of U.S., 288  
Vestibule labs, 190  
Violence, 47  
Vocational classes, early, 59  
Vocational education—  
    and industrial arts, 32, 246  
    role and relationships, 248  
    vs. general education, 72  
    skill centers, 64  
Vocational high school, 60  
Vocational program, area, 65
- War, societal problem, 43  
Wealth, societal, 20  
Work—  
    conditions of, 295  
    culture of, 293  
    definition, 189  
    divisions of, 223  
    and education, 73  
    experience, 103  
    observation of, 104  
    preparation for, 83  
    reality of, 288  
    world of, 29, 287  
Work world, education includes, 221  
Work-study, 179, 230  
Workers, nature of, 90  
Workplace, and educational  
    development, 146