TEACHER COMPETENCIES
FOR THE CYBERNATED AGE

monograph 3

AMERICAN
COUNCIL ON
INDUSTRIAL ARTS
TEACHER EDUCATION

TEACHER COMPETENCIES FOR THE CYBERNATED AGE

by

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PREFACE

This is the third issue in a series of monographs that is published by the American Council on Industrial Arts Teacher Education. As significant contributions are brought to the attention of the Council's Publications Committee, monographs are printed and distributed to members of the council and the profession. A fixed schedule has been avoided, thereby permitting publication as material is available.

Among the primary sources of manuscripts are the committees of the ACIATE working on problems facing industrial arts teacher education. When the findings of the committees are too extensive for presentation in one of the professional journals or the results are limited to the interests of teacher educators, these may logically become material for a monograph.

The Publications Committee may also, at their discretion, solicit manuscripts from ACIATE members or representatives of related disciplines. The primary objective of the committee will be to select information for publication that will advance the profession of industrial arts teacher education and fulfill the goals of ACIATE.

Monograph 3 is similar to monograph 2 in that it is the product of research and writing of two of the Council members, Ronald W. Stadt and Larry J. Kenneke, rather than the work of an ACIATE committee, as was monograph 1.

Within the last few years, one-third of the industrial arts teacher education programs have changed the titles of their departments to include the word technology. While technology has been one of the key factors in the growth of our society since the dawn of civilization, it has only been during the last fifteen or so years that the public has been seriously concerned with its impact. A number of writers and philosophers inside and outside the profession of industrial arts teacher education have been calling our attention to the necessity of technological understanding.

Stadt and Kenneke have written a manuscript that reviews the impact of technology upon man and his world and the implications this holds for industrial arts teacher education. In suggesting some rather drastic changes in the content and method of industrial arts, this document raises some pertinent questions.

The officers of ACIATE and the Publications Committee wish to express thanks and appreciation to the authors, Ronald W. Stadt and Larry J. Kenneke, for the work they have done in preparing this manuscript.

Credit for the success of the monograph series must be given to the Publications Committee. Strong leadership and committee membership is the only way that a publication can be put into the hands of our members. The present committee is headed by George Ferns and assisted by Elmer S. Ciancone, Raymond L. Cornwell, Louis G. Ecker, William Kemp, Angus MacDonald, H. James Rokusek, Alan R. Suess, and Richard J. Vasek. Daniel Householder, former Publications Committee Chairman was instrumental in initiating the preparation of this manuscript.

Questions concerning the publication of future monographs should be directed to the secretary of ACIATE, who will put you in touch with the chairman of the Publications Committee. Questions or comments concerning the content of this monograph should be directed to the authors, Ronald W. Stadt and Larry J. Kenneke.

FREDERICK D. KACY
President—ACIATE

TABLE OF CONTENTS

INTRODUCTION

Nearly all are agreed that experiences in industrial arts* should foster intelligibility of man's efforts to produce goods and services, or, in a word, industry. The major issues concern scope and structure of instructional content and methods of instruction. These issues serve as a challenge to top-level administrators, middle-management personnel, teacher trainers, supervisors, teachers, and to those who would strive to provide relevant educational experiences.

Concerned educators are charged with the responsibility of identifying content and organizing instruction so that the educational experience incorporates systematic effort, utilizing both human and technological resources and directed toward clearly defined goals. In order to fulfill these responsibilities industrial arts must undergo extensive curricular changes. Changes must be so great that it (industrial arts) will be unrecognizable as either "industrial" in scope or "arts" in substance. This subject matter area must respond dynamically to the changes in technology and to man's role in the world of work. It must become relevant to advanced technology *and* the contemporary needs of real people with real learning characteristics and real career pattern potentialities. The nature of contemporary productive society and its impact on modern man must be understood by those who would resolve issues in that part of education which would make productive society intelligible to youth.

*The authors prefer the term "Enterprise: Man and Technology" to the traditional term because its scope should not be limited to industry, and it is obviously not art. However, because it is not within the scope of this monograph to discuss such a name change, the traditional term will be used when necessary.

CONTEMPORARY TECHNOLOGY

Obviously, science and technology will continue to grow exponentially in the years ahead. The forthcoming stage of technological advance is destined to be the most expansive in history. What lies ahead will be difficult to comprehend in the light of past achievement. No major, single technological discoveries, such as television or computers, appear likely. Rather, all manner of highly complex interactive developments will occur. These will affect society in several important ways. It appears that man's relationship to technology will be better understood, and that much effort will be devoted to the development of systems and techniques which benefit both.

Such developments will be fostered by the technological elite, i.e., key people in the electronic, aerospace, chemical, communications, and other sectors of industry and government. Corporations such as General Electric, Dupont, Boeing, Litton, and CBS will command varying degrees of leadership in the human use of technology. These and other omnipotent enterprises will foster the utilization of such developments as coherent light, superconductivity, materials science, and energy conversion for the benefit of mankind.

Totally new industries will result from these sorts of innovation. At the same time, old or obsolescent enterprises will be rehabilitated. New life will be breathed into institutions which are threatened by emerging technologies.

Discovery and utilization of the principles which govern coherent light will result in heretofore undreamed of technological feats. The major contributor to these advancements will be the laser. Basic laser theory, formulated by M.I.T.'s Dr. Charles H. Tounes and the Soviet Union's Basov and Prokorov, points to the organization and subsequent development of vast new industries. To date, significant advances have occurred in data-display systems, large screen television, communications and three-dimensional photography. Nearly a hundred laser applications are already operative and many more appear on the horizon. Experts predict that the laser will account for one billion dollars of industrial and commercial production and sales by 1970.

Discoveries made in the Bell Telephone Laboratories between 1954 and 1961 account for much of the burgeoning new field of superconductivity. Such technological breakthroughs enable electric current to pass through supercooled wire without losses commonly experienced in the transmission of energy. This is by far the closest man has come to perpetual motion. Large savings may be achieved through superconductive, underground transmission lines. Existing electrical cables lose nearly 40 percent of the current flowing through them. Superconductivity holds the promise of smaller, more operable transformers, generators, and motors. Computers of unheard of capabilities and speed will be developed for solving problems related to magnetohydrodynamic and thermonuclear power. Because superconductive devices are fundamental to all manner of industrial technology, applications will be ubiquitous.

Energy-conversion devices represent a third major technological breakthrough. Such developments have been necessitated by the energy demands of space vehicles and manned orbital flight. Developments include silicon solar cells, atomic batteries, rechargeable batteries, thermionic tubes, and heat pumps. Whereas many of these devices are still in the experimental and high-cost developmental stages, widespread utilization of same is just around the corner.

These advances will endanger a number of kinds of industries. Rehabilitation of outmoded enterprises will be a major problem. Organizational structures, degree of horizontal and vertical integration, labor contracts and other variables will need to be modified by enterprises which would keep pace with accumulating technology. The mechanical means to alter these conditions exist, but major social, economic, and political obstacles remain.

Major changes result because of external forces. Witness 60-second pictures, computers, and Xerography. Polaroid film was not developed within conventional photographic enterprises. Computer technology resulted because of the demands of the ballistics industry, not because of the demands of regular consumers of data processing equipment. Chester Carlson, the promoter of Xerography, was turned down by approximately 20 enterprises before he found one to market his copier. The task of remaking old industries requires impetus far beyond the capability of most waning enterprises. In most instances, only industrial giants or the federal government can restore life to outdated enterprises.[1]

Perhaps the most startling contrast between contemporary technology and that of earlier periods is the relative importance of thing making and information processing. In previous times, production of physical objects was much more important than the production of information which was used to control production and related functions. Many farmers and smiths kept necessary records in their heads. Now when we examine various aspects of productive society, we learn that information processing consumes more of our effort than do the making of goods and rendering of services.

In many highly mechanized industries, it is obvious to even the casual observer on a plant tour that there are more people in departments such as accounting, sales, and marketing than in production. The production and distribution of electricity is probably the most vivid example of this concept. It is difficult to find anyone doing anything which is not purely and simply information processing. Once power lines are hung or laid and connected to factories, stores, homes and the like, it is only maintenance workers in the neighborhoods and in the power plants who do physical things to abet production and delivery — and with modern materials, component design, and manufacturing (which are themselves aided by modern information processing) maintenance becomes less important too. Accounts receivable and accounts payable involve ever more complex processing equipment.

People in more and more segments of the economy, devote more effort to planning, scheduling, coordinating, and record keeping than to production. Much of this trend is the result of requirements of government, suppliers, customers, and internal departments for more complete, accurate and timely information. This is why it still takes a ton of paper to make a ton of steel. Government agencies require more and more information as legislation and administrative policy regarding taxes, grants, subsidies, contracts, and the like become more complex.[2]

Suppliers want detailed information about the functions materials and products are going to serve, the methods for storing, and many other variables. Concern for testing and inspecting materials and processes becomes more and more important in industry, trade, business, commerce and public sectors of the economy. A relatively minor and unsung change in Food and Drug Administration policy can require large segments of the economy to become concerned with the hiring and training of quality control workers and record keepers who add to the kinds and numbers of people who gather and process information but don't make things or perform services of value in and of themselves. What was once a definitive dividing line between government and business is now an every man's land of complicated interrelated concerns which require *much* additional information.

As an industry moves to cost benefit analysis, profitability accounting, and other sophisticated techniques which require much more internal information flow, its suppliers also demand more and more information. One of the largest kinds of information concerns financial well-being. Whereas major corporations used to be granted credit on reputation and good name, all but the giants are now required to furnish sophisticated suppliers with much more financial information than the stockholder can glean from profit-and-loss statements and balance sheets. Corporations must supply data from which supplier credit managers may compute all manner of financial ratios before granting credit.

For different reasons customers want information too. Supermarket companies want sales performance information from companies who stock their

[1]Lawrence Lessing, "Where Industries of the Seventies Will Come From." (New York: American Management Association, 1968), p. 3-7. (Mimeographed.)

[2]Harold T. Amrine, John A. Ritchy, & Oliver S. Hulley, *Manufacturing Organization and Management* (Englewood Cliffs: Prentice Hall, 1966), pp. 25-46.

shelves. Department stores and other customers demand production planning information from clothiers, furniture manufacturers, and other enterprises so that sales promotion campaigns and other business activities can be coordinated and done well. Customers also want financial information on supplier companies so they may be assured of continuous supply.

All but one of two major steps have already been taken to put personal, academic, social, and financial information on all high school seniors and their parents into one, huge information pool and to let colleges and other agencies draw upon it at will to grant admission, scholarships, work permits and the like. In all segments of the private, public, and non-profit sectors of the economy, information processing is taking on ever greater proportions. Collectively, but without a grand design, we are very much concerned with keeping financial, medical, educational, and employment records on every man, woman and child from birth to death. There is serious talk about establishing a federal information storehouse which would pull together and coordinate existing systems. (There are plenty of examples such as ERIC which attest to the effectiveness of nationally controlled, decentralized, and omnipotent information systems.)

Increasingly, information processing involves an intimate symbiosis betweent computers and human thinkers. Planners in government, corporation, hospital and church constantly have before them the problem (1) of assuring close and working relationships (with minimum time loss and maximum understanding) between man and machine and (2) of deciding how much of the labor of information processing will be done by computers and how much will be done by men.[3] (The decision is made after the fashion of all other economic decisions, and men are not given special consideration.) As computers become more numerous, flexible, inexpensive, and skilled, they will do more of the work. This is a condition of the age.

[3]William V. Haney, *Communication — Patterns and Incidents* (Homewood: Irwin 1960), pp. 1-11.

IMPACT OF TECHNOLOGY AND INFORMATION PROCESSING UPON MAN AND HIS WORLD

ON PRODUCTIVITY

There is an economic regulator which prevents automation from becoming distinctly different from previous production modes. It is the rate of investment in capital equipment and *training*. Because perpetuation (which usually includes growth and profit) and not glamour is *the* motive, companies with intelligent management do not purchase machines which are uneconomical. Computers are not introduced in performance centered firms unless they do work less expensively than humans — the cost of labor negotiations and everything else included.

Put another way, macro and micro systems have a number of built-in controls. Productivity, capital equipment, manpower resources, training, and consumer demand and buying power are inextricably related. One cannot run wild; each is checked by the others. This fact alone is sufficient explanation of the reason why many predictions regarding the rate of mechanization have not come about. Computer-controlled production systems have not been introduced at nearly the rate which the more radical predictors had prophesied. The vast majority of computer applications have been in accounting and clerical departments; relatively few applications have been made in production and design departments. True, much of design in industries where problems involve higher mathematics, e.g., aerospace, has been computerized. True, materials handling and many other production related functions have been computer controlled in automotives, utilities and a few other industries. But the fact remains that computers in contemporary industry and business are primarily assigned to speeding routine accounting and clerical applications. For the most part, they do what clerks and assistant accountants used to do. Only recently have significant numbers of computers been sold because they are able to do things companies didn't do before — sophisticated market studies, operations research, profitability accounting and other scientific approaches which help to assure success in a more and more mixed, complex, and competitive economy. (In the educational enterprise too, until now, computers have been used for the clerical work of registrars and budgeters. Only now are we beginning to apply computers to production situations, i.e., to teaching, in significant degrees.)

The computer industry is inextricably wrapped up in training — knowingly and by design. Selling a computer or leasing computer time to a company or agency which has not used electronic information processing before nearly always involves hiring one or two key people (who may have undergone a recent training program themselves) and training a small number of the existing work force. The care and feeding of sophisticated equipment of any kind cannot be left to the uninitiated, and thus the introduction of computers presupposes training of competent operators and other personnel. When they are not available, or when their wages and the cost of equipment exceeds the cost of doing without the computer, the computer is not introduced. Although the variables are complex, simple dollars-and-cents economics controls the demand (and supply) of computers.[4]

ON CONSUMPTION

There is little doubt that the goods of productive enterprise can be consumed. We are living in an age of "more." We have "more" automobiles, "more" sports gear, "more" television sets, "more" of everything. As the years pass, the populace will demand even more in terms of manufactured products, goods and services. It appears that families will have little difficulty with spending requirements, as the average annual family income becomes $15,000 instead of $7,500 or $30,000 instead of $15,000 two generations hence.

The economy has an enviable record for providing a high standard of living and preserving substantial economic freedom. While the early years of the Republic provided little individual security or equal opportunity, the last quarter century has witnessed great advances in both.

The performance of the American industrial engine is without precedent in history, in fact, without parallel in the world today. The achievements which have made productive society what it is are taken for granted. Life expectancy at birth rose from 55 years in 1919 to 70 years in 1959. Americans not only live to be older, but they do not have to work the long back-breaking hours of yesteryear. In 1900 the average workweek was 60 hours. Today the average number is 40 hours. Yet today one hour of work will purchase three times as much as it did in 1900. It now requires three minutes of work to purchase a pound of sugar, 12 minutes to buy a dozen eggs, and 21 minutes to purchase a pound of butter.

If we were to distribute present personal incomes evenly among our country's approximately 50 million families, we would find that each family would have an income of approximately $10,000. Thirty million families own and live in their own homes. Nearly all homes are equipped with electricity and major appliances. Ninety percent of all American homes have washing

[4]Paul A. Samuelson, *Economics* (New York: Harcourt, 1966), pp. 799-817.

machines and television sets. Automobiles are owned by three out of four families. Approximately 80 million telephones jangle the nerves of society. Statistics for given years provide validity for previous inferences: in 1963 consumers spent $37 billion on clothing and personal effects; approximately $20 billion on tobacco, soft drinks, liquor, candy and gum; and $22 billion on recreation. Contemporary Americans have available to them a more nutritious diet — more varieties of meat, vegetable, fruit, and dairy products — than did the elite of any previous culture.[5]

The nature, structure, and environment of our society have perpetuated a form of democratic diffusion unlike any previously known to mankind. Our productive environment has enabled the masses to achieve what few have been able to obtain in most other countries. This environment will continue to foster growing demands for better lviing accommodations, increased geographic and social mobility, widespread higher education, improved health care, and more intellectual employment.

Domestic concerns exert and will continue to exert pressures for continued growth on the economy. Social, political, educational, and economic upheavals foretell a greatly enlarged middle class. We are becoming increasingly aware of the necessity to alleviate air and water pollution, inadequate police and fire protection, inadequate social services, urban decay, traffic congestion, and other unwanted by-products of the age. Non-domestic concerns also foretell economic growth. Many citizens support the expenditure of gigantic sums of money on military equipment in order to discourage aggression. A majority support the expenditure of vast resources for the exploration of outer space for prestige and scientific benefits. Some segments of the population insist that we must be the guardian of weaker, underdeveloped nations. It is certain that we will continue to protect their independence and provide economic aid for industrial, social, and intellectual reform.

Although there is little doubt that consumer demand will be very great in the future, it is evident that the desire for goods and services will change in substance and amplitude. Proportionately less will be spent on luxurious consumer items, and more will be spent on essential social services. We will be less concerned with the consumption of frivolous material objects and more concerned with widespread availability of social, medical, and other services.[6]

ON EMPLOYMENT

The impact of contemporary production modes upon employment is not startling. It is a fact that the American economy must (1) provide 2 million new jobs each year to offset increases in the labor force, and (2) provide an additional 2 million new jobs for workers displaced by increased productiv-

[5]*Ibid.*, pp. 111-121.
[6]John K. Galbraith, *The New Industrial State* (Boston: Houghton Mifflin Company, 1967), pp. 36-41.

ity. In part, new jobs are created by the entrance of new workers into the labor market. Additions to the labor force mean complementary additions to potential demand for products, goods, and services. Likewise, increased productivity spawns new jobs by increasing the purchasing power of the nation's citizens. There is little doubt that continuous employment for the masses will be achieved.

A generalized review of the causes of instability and an analysis of anti-recession forces will validate previous inferences. The early years of the American economy were beset with numerous inventory recessions which often snowballed into widespread economic declines, overproduction, and subsequent unemployment. Inventories were primary causes of economic instability and subsequent erratic employment patterns. Inventory fluctuations for numerous enterprises are dependent upon the difference between the sum total of production and final sales receipts. In order for inventory accumulation to occur, productivity must outstrip consumer demand. Obviously then, for inventory liquidation to occur, the reverse must be true. When inventory accumulation is pursued with vigor, an upward spiral forces the economy into overproduction before consumption can occur. Enterprises, then, pursue liquidation policies, triggering a falling spiral and making it extremely difficult to decrease inventories. The factors leading to such self-defeating activities arise from the close interrelationship of production and sales, for production generates sales and sales demand production.

When entrepreneurs detect a forthcoming boom and subsequent price rise, they resort to inventory accumulation. The primary objective, of course, is to stock-up on products at a minimal cost and, in turn, sell them at higher prices. This naturally causes production to spiral upward. In turn, the production increase has a vast effect upon employment and incomes. As paychecks grow, so grow sales. Ultimately, too many goods are accumulated, and production outstrips sales. Then, with storehouses bulging with goods, managers reduce purchases and production and attempt to rid themselves of inventories. Enter the recession; production slows, employment dwindles, paychecks grow thin, and sales decrease.

Thus, at frequent or periodic times in our economic history, we have been plunged into financial doldrums which resulted in layoffs, or shutdowns, bankruptcy, market declines, and lost savings. Often it was months and even years before the engine of industry could once again move forward. There was no such thing as individual security, for entrepreneurs and workers alike dared not rely on the solvency of their investments, endurance of enterprises, or permanency of their employment.

During the past quarter century we have witnessed great improvements in the maintenance of a stable economy. Steadily rising sales and increasing employment without fear of overproduction, inventory liquidation, and subsequent unemployment have been achieved through the application of sound

governmental policy and "automatic" or "built-in" stabilizers. Government regulation of the public deficit or surplus, interest rates, and money supply have contributed much to ensure individual incomes of a sufficient level to purchase the products, goods, and services of American enterprise. Continuous employment is rapidly becoming a reality, and if layoffs occur, laborers may draw upon unemployment benefits. Numerous personal risks are further minimized through insured savings, social insurance, industrial accident insurance, and regulation of security transactions. Such monetary and fiscal policies are aimed at sustaining continued employment, production, and consumption.

Although the economy still fluctuates, swings are not nearly so great as those of the 1837 or 1930 depressions. Whenever periods of decreasing production and employment appear, anti-depression policies are brought into play. These concern interest rates, corporate taxes, social security benefits, personal income taxes, and the like. Increasingly, agencies in the private sector voluntarily adopt policies of strict management of wages and costs during inflationary or recessive periods. Such policies are adhered to in preference to increased revenues. Continued payment of wages in times of recession is possible if profits and savings are large enough beforehand. Such sacrifices assure retention of the skilled work force and maintenance of consumption levels. Of course, pressures from labor unions encourage the decision to accept lower profits and reduced savings.

Another effective stabilizing force is the mandatory corporate income tax. When profits decrease, corporate tax payments fall, and the pressure of a downward trend is reduced. This adjustment is automatic and requires no legislation or executive action.

Social security benefits are the third built-in economic stabilizer. Never before has the American worker enjoyed such economic protection. Government payments to unemployed people automatically rise as workers are laid off. Furthermore, those citizens who do not qualify for unemployment benefits are entitled to special retirement and relief programs.

Personal income tax contributions also serve to stabilize the economy in times of recession. Income tax payments automatically decline as do individual wages during hard times. Thus decreases in after-tax incomes are smaller than decreases in before-tax wages. That is, a portion of losses incurred by workers is absorbed by the government.

Finally, the persistent purchasing activities of the consumers themselves during recessions are a pertinent factor in stabilization of the economy. Traditionally, during times of recession Americans have decreased their rate of savings. However, many forms of consumption cannot be readily curtailed in times of recession and tend to bolster the economy.

Because he foresaw the possibility of these stabilizers, the well-known and respected economist John Maynard Keynes inferred that it was entirely feasible for a government to regulate the supply of money, rates of interest, and deficits and surpluses. He emphasized that appropriate federal intervention could ameliorate over production while assuring full employment and income levels which permit adequate consumption levels.[7]

ON LEISURE

As American enterprise becomes more efficient, economic fluctuations disappear, employment remains steady, and consumption continues. Workers receive a portion of their rewards in the form of additional leisure time. The shortened work-week, more paid holidays, earlier retirement, sabbaticals, and extended vacation periods are a fact of the day. Such rewards for increased production will multiply at a tremendous rate within the very near future. It should be emphasized that such leisure is not a fabricated capitalistic scheme to avoid unemployment; instead, it is a choice from among many alternatives made possible by ever increasing wages and salaries. However, a just question arises: Does increased leisure time constitute a threat to mankind?

We and our progenitors were nurtured in an environment which was alleged to reward those who worked hard and applied themselves. "Work long hours, keep your nose to the grindstone and success will be yours." For centuries we have labored under the misapprehension that man is inherently lazy, must be forced to work, and is incapable of utilizing spare time for his own best interests. We have suspected that there is a high correlation between idleness and sin or immorality. Early economic philosophers impressed this thinking upon industrialists when they suggested that wage rates be as low as possible, for, after all, higher wages would only lead to increased leisure time, which would only lead to drunkenness, unbecoming behavior, and overpopulation.

Admittedly, some such activities have occurred and will continue to occur in varying degrees. Surely, as man gains leisure, he will engage in some activities which are not for his own benefit, but such actions should not be construed as representative of the human race. Rather they should be viewed as warnings of what may occur if challenging opportunities are not available to those citizens who enjoy extended periods of leisure.

It is important to interpret man's actions in light of his nature. They should be viewed as man's continuous striving toward more perfect actualization of his humanness. The noted behavioral scientist Abraham Maslow submits that man's quest for self-actualization is analogous to the naturalistic, scientific way in which an acorn may be said to be "pressing toward" becoming an oak tree.[8]

What then, is man trying to achieve? What are the characteristics of

[7]Samuelson, *op. cit.*, pp. 177-211.

[8]Abraham Maslow (ed.), *New Knowledge in Human Values* (New York: Harper, 1959), p. 128.

people who realize their self-concepts? First of all, few men achieve complete or total self-actualization. For the multitudes, self-actualization is merely a yearning, a wish, a drive for something that is rarely obtained. Such wishes may be a striving for growth, health, integration, etc. A majority of human beings do not achieve major goals because they are engaged in the battle for life. They are totally absorbed in fulfilling basic human needs. While most Americans have sufficient food, clothing, and shelter, they are deeply involved in the process of improving and protecting these aspects of their environment. Vast quantities of human energy are spent on such endeavors — for who can deny that one should not provide the best of everything for his family?

Through advances in technology, economic sanctions, social reform, and labor solidarity, the majority of workers have been able to fulfill many of their basic human needs. As efficiency increases and incomes rise, workers receive a percentage of increased productivity in the form of shorter working hours. Prosperity and leisure not only enable individuals to maintain desired living standards, but also foster broadened and heightened self-concepts. Expanded leisure allows examination and analysis of what is real, good, and true. Man can pursue the higher qualities of life only if his basic desires are satisfied. Relative freedom from work permits the development of insights which enhance differentiation of ends such as peace, solitude, and repose and of methods such as dollars, influence, and position. Leisurely man is better able to negotiate to minimize cruelty, aggression, and other inhuman activities. He can pursue mutual understanding among the peoples of the world and achieve cooperation heretofore unrealized.[9]

ON THE UNSKILLED

Technological advances in business and industry are bringing about great changes in expertise demands and the composition of the work force. The entire work force is altered by accelerations of the mechanization rate. Technological advance will continue to require more highly sophisticated workers in nearly all parts of the public and private sectors. There will be significant increases in the numbers of professional, semiprofessional, and skilled workers. As segments of productive society become more mechanized, employment patterns change. In most instances some of the unskilled move to skilled categories. Likewise, some who were previously in skilled categories are retrained for technician or semiprofessional level positions.

In large part, technician level personnel come either from the pool of people who are joining the labor force or from lower levels in the work force. Many are recruited from four year colleges and other post-secondary educational institutions. It appears that there will be an ever increasing need for automation specialists in more and more segments of the economy. It follows that the demand for competent maintenance workers and related classifica-

[9]*Ibid.*, pp. 129-130.

tions will foster a proportionate increase in the highly skilled and skilled categories. The characteristics of work in these categories will change, and people will change jobs from time to time, but real numbers and percentages of the total labor force will increase. Conversely, decreases will result at the semi-skilled and unskilled levels. The most decided decrease will continue to be in the unskilled category.

As highly sophisticated applications of technology become more widespread, the economy is put to more rigorous tests. Whereas mechanization possesses great potential for increased production, it can also eliminate individual incomes and thus limit demand for its own products and services. There is great need for schema which assure high consumption levels despite reduced manual employment. The now classic conversation between a Ford executive and Walter Reuther epitomizes this. The story goes that on a tour of a highly automated plant in Cleveland one of the Ford executives pointed to a series of automatic loading machines and teasingly said to Mr. Reuther, "You will have a hard time collecting overtime for those guys." Mr. Reuther replied, "And you will have a hard time selling them Fords."[10]

Government, private enterprise, and organized labor have plans by which they allege the economy may be modified to assure high levels of consumption and production. Some programs for guaranteed annual wages and automatic hourly rate increases are already in effect. Such plans are certain to become more universal. Industrialists submit that lower unit costs will assure continuous, widespread markets for the products of automated factories. They maintain that the ever-expanding economy will provide employment for all who are displaced by technological change together with 700,000 new workers annually.

Employment for new and displaced workers is not as readily assured as many assume. Widely varied and accepted occupational education and retraining are the keys to continued high employment. Continuous programs of job training must be of prime importance to private and public enterprise and individual workers. Occupational education in many institutions will involve continuous expenditures of large sums of money. Retraining will continue to require sacrifice and commitment of employers and employees. Frustrated and anxious people will have to readjust self-concepts, skills, knowledges, and job satisfactions in an ever changing world.

Social and economic crises will be magnified as automation spreads. The issues confronting us remain: To what degree should society assume the responsibility for retraining workers? Who must absorb the financial burden of providing workers with the skills required for advanced technological employment?

Since continued employment assures social and economic welfare, it appears that government will assume much of the cost of retraining workers.

[10]Robert Dubin, *The World of Work* (Englewood Cliffs: Prentice Hall, 1958), p. 206.

Updated and expanded programs in secondary schools, vocational-technical institutes, community junior colleges, and other institutions will do much to accomplish national and regional goals. Through cooperative programs involving on-the-job instruction and relevant classroom experiences, displaced workers can achieve levels of proficiency and appropriate attitudes for re-entry into the world of work. Emergency programs will be initiated to alleviate specific manpower needs. Greater emphasis will be placed on assisting displaced workers to maximize opportunities.[11]

ON MOBILITY

It is common for the contemporary worker to change jobs or place of employment or both several times during his working life. As rate of mechanization and other results of technological advance increase, more and more persons will engage in a succession of jobs through the working years. This characteristic employment pattern is the result of several factors such as ambition, change, and labor market conditions.

A majority of Americans are greatly concerned about furthering their careers. Widespread ambition encourages a high level of job mobility. Half to three-quarters of all voluntary shifts in employment are made with anticipation of climbing the occupational hierarchy. The prevalent theme of our social value system has been one of "getting ahead in the world." Getting ahead means obtaining a better position, and one's socio-economic standing is determined, in large part, by one's job classification. Changing jobs is a means by which individuals pursue "happiness."

Many workers voluntarily change employment for non-job-related reasons. Palmer (Labor Mobility) suggests that many workers are not concerned with climbing the occupational ladder. Research indicates that as much as a quarter of the American labor force is indifferent to the idea of "getting ahead." Such individuals prefer to "play the labor market" and take what comes their way. These workers are characterized by concern for earning a wage or salary and indifference to specific jobs or fields. Palmer reported that one in every four job changes among males was the result of personal or family circumstances. Voluntary changes among women workers were ascribed to personal or family reasons in one out of every two cases.[12]

The changing nature of American enterprise with subsequent changes in the supply and demand for workers is the third factor which impinges upon worker mobility. A review of the character and nature of productive society serves to point out the changing needs for occupational competence. Nearly 40 percent of the population are engaged in productive efforts. They are concerned with fulfilling growing demands for clothing, shelter, food, and

[11]*Ibid.*, pp. 199-202.

[12]Gladys L. Palmer and Ann R. Miller, *The Occupational and Industrial Distribution of Employment — 1910-1950*, William Haber, et al., eds., *Manpower in the United States: Problems and Policies* (New York: Harper, 1954), pp. 273-76.

personal services. Of the nearly 80 million persons engaged in productive efforts, more than a third are women. Approximately one out of seven workers is self-employed or working in a family business. Private enterprise provides jobs for a majority of the labor force while federal, state, and local governments provide employment for roughly 11 million workers.

A movement away from goods-producing industries is evidenced by numerous private and public studies of employment trends. Despite this long-term trend, manufacturing still remains the largest employer of manpower. In 1965 approximately 19 million people were employed by organizations which produced goods. Trades and services employed nearly 13 and 14 million persons respectively.

Mechanization has brought and will continue to bring changes in employment patterns. Manpower needs in production will expand only half as fast as other areas of employment. The greatest growth areas for employment will be in government, services, and contract construction enterprises. Demands for all manner of services have been intensified by innovation and discovery in the areas of health, education, and welfare.

Employment growth will be highest in those fields which require the most extensive training and education. Professional and allied occupations will exhibit the greatest growth in the next decade. Employment needs in these fields will grow twice as fast as all other forms of employment combined. Employers will seek workers who possess high levels of education to fill increasingly more complex jobs. The need for service workers will increase by nearly 3 million persons over the next decade. While the service fields encompass a group of workers with diverse abilities, a majority of the 3 million openings will be for individuals possessing high level technical competence. Semi-skilled occupations will account for an increase of approximately 4 million jobs over the next decade. Finally, the projected demand for unskilled workers over the next decade will be less than one-half million.[13]

Professional level manpower needs will be centered in scientific and technical work, teaching, health, and the performing arts. At present, nearly 9 million persons are employed in the professions. Scientific-technical employment will grow faster than other professional groupings. The need for life scientists alone is expected to increase by more than 80 percent in 10 years. Employment needs for physicists, mathematicians, and scientists will approach a 75 percent increase in the same time period. Demand for engineering and scientific technicians will increase 62 percent.

Enrollments in the nation's schools are likely to exceed 60 million pupils by 1975. In order to maintain high quality education the nation's instructional work force must increase by approximately 650,000. Additional teacher shortages will result from vacancies created by retirements, transfers, and death. Such shortages will require an additional 1.8 million certified personnel.

Growth rates in health-related occupations will vary widely. The supply of workers will have to be expanded a great deal to fulfill increased demands for improved health services. Demands for medical technologists will increase by 100 percent from 1965 to 1975. Needs for dental hygienists, medical record librarians, and registered professional nurses in the next decade will increase by 80, 45, and 42 percent respectively.

Performing artists will likewise account for a large area of employment growth. There will be similar demands for accountants, clergymen, lawyers, counselors, social workers, and librarians.

Clerical occupations will continue to grow and change with the introduction of technological advances. This grouping includes occupations ranging from bookkeepers, secretaries, and typists to electronic computer personnel. Unit record and office machine operators will increase by 140 and 102 percent in the next ten years. The demand for typists, secretaries, stenographers, and lower-level workers will increase by a much smaller percentage.

Service occupations account for nearly 9 million workers. These occupations include persons employed in food services, private households, custodial work, protective services, and death services. The greatest growth is predicted among service workers employed outside of private households. Employment among protective service workers, food service workers, and hospital attendants is anticipated to rise from 5 million in 1965 to nearly 10 million by 1975.

Between 1965 and 1975 requirements for skilled workers will increase by approximately one-fourth, from 9 million to about 11.5 million. This segment of the labor force includes construction workers, mechanics, and machinists. Over one-half of the projected job earnings in this area will result from growth and the remainder will result from retirements, transfers, and deaths. The greatest demand for skilled workers will be for automobile mechanics, plumbers and pipefitters, and carpenters.

Presently, the largest of all occupational groups is the semi-skilled category. This category will have less than average employment growth. Factory hands, local truck drivers, routemen, taxi cab drivers, deliverymen, and the like are in status quo occupations.

Employment history and trends suggest that productive society and manpower resources are in a continual state of change. It is not uncommon for the contemporary worker to change jobs or his place of work or both several times within his life. As automation and other concommitants of technological advance are introduced in the economy, greater employer and employee mobility results. The greatest advancement opportunities will be afforded aggressive, educated workers. Women will assume tasks which heretofore have been reserved for males. More workers will transfer into entirely new fields of

[13]United States Department of Labor, Bureau of Labor Statistics, *Occupational Outlook Handbook*, Bulletin No. 1550. Washington: Government Printing Office, 1968-69. pp. 13-14.

work, and there will be greater geographical dispersion of productive units. Therefore, schools must foster the type of education which will aid and abet occupational and geographical mobility.[14]

[14] *Ibid.*, pp. 15-30.

IMPLICATIONS FOR INDUSTRIAL ARTS TEACHER EDUCATION

It is commonly maintained that industrial arts must undergo major curricular changes. Unlike efforts in other subject matter areas, changes in industrial arts must be so great that it will be unrecognizable as either "industrial" in scope or "arts" in substance. If this subject matter area is to familiarize young people with performance models in the world of work (and remain alive to do so), it must come of age. It has responded little to changes in technology or man's role in the world of work in its relatively short history. If it wishes to survive, it must attempt excellence *and* relevance to characteristics of modern technology and contemporary needs of real people with real learning characteristics and real career pattern potentialities.

One of the major vehicles for assuring excellence and relevance in any subject is teacher education. It appears doubtful that there will be any major changes — say at the level of reorganization — in what is now called industrial arts which are not initiated by teacher educators. If publishers and/or equipment suppliers for schools realize opportunities made possible by recent legislation, they may develop instructional packages which are not confined to traditional subject matter organizations, but it appears that any significant changes must come from the campuses.

Industrial arts teacher education experiences must be attuned to contemporary productive society. Its content must account for both the technological and the human sides of all manner of enterprises in the world of work. Coursework and related experiences must create awareness of and lend understanding to the problems of organizing, directing, controlling, and evaluating the efforts of men and technology at work. Understandings of the human side of enterprise are as essential as understandings of the technical side of enterprise, particularly to teachers who would help youth to assume adult roles in productive society.

ABOUT MAN AND THE LABOR FORCE

Teacher educators must design or select courses in the social and especially the behavioral sciences which attempt to describe the relationships of men with men, machines with machines, and men with machines. Teachers need to know what economists, sociologists, psychologists, and others know about man at work.

Some courses not unlike those which are required of management majors should be required of those who would make man and technology understandable in the schools. Fundamentals of human interaction at work; authority, power, and status structures in sundry organizations; theories of organization and methods for their utilization in small, medium, and large enterprises; the interaction of formal and informal organizational structures; the importance and implications of the principles of differentiation and integration of work tasks on production lines and elsewhere in the world of work; the history and present import of labor unions and professional associations — these and many other features of the human side of enterprise must be known by good teachers.

What industrial social psychologists know of the nature of occupations, work groups, and attitudes on the job is important to all teachers, especially to our kind. Career patterns and trends; authority, power, and status characteristics of jobs at sundry levels of the responsibility ladder; characteristics of leadership in differing kinds of enterprises; the economics of obsolescence and automation; seasonality of certain jobs; physical conditions of work, financial and fringe benefits; opportunities for creative effort and recreation at work; location, mobility potential and geography of occupations and careers; promotion, training and advancement potential — these and many lesser features of many kinds of occupations must be known by those who would shoulder prime responsibility for starting the young over the bridge between school and immaturity to work and maturity.

Characteristics and composition of the labor force should be a separate area of study. Ages, educational levels, ethnic and racial backgrounds, mobility, sex, and other characteristics of the work force should be defined. Subsequent study should point up the implications of recent trade union and professional association developments upon jobs and employment. The labor force should be analyzed in terms of the above characteristics and the distribution of mental and manual skills, changing requirements, seasonal fluctuations, geography, and other descriptions which will help the young to understand work the way the farm boy understood it three or four generations ago.[15]

ABOUT THE ECONOMY

Fundamentals of micro and macro economics are important to intelligibility of the world of work. Analysis of the operation of an economy in the determination of product and service prices, wages, levels of output of the enterprise, and distribution of income, together with the role of governments

[15]James Brown, *The Social Psychology of Industry* (Baltimore: Penquin, 1962), pp. 186-218.

in each is important to the preparation of industrial arts teachers. The methodology of economics; the determination of national income, employment and output; money and banking policies; economic fluctuations and the impact of government monetary and fiscal policy on same are important fare for those who would instruct the young regarding participation in economic, social, and political society.

Industrial arts majors should come to understand the economics of business affairs. The role which mechanization, e.g., automation and electronic data processing, has in determining employment levels, consumption levels, and economic well being must be known by the future teacher, who, more than any other adult, will be responsible for acclimating the young to the world of work. In short, the system whereby men combine scarce or limited resources, i.e., labor, land, capital, machinery, tools and techniques, to produce and distribute commodities and services to ever larger segments of the national and world communities must be understood (above all else) by those who would make participation in the system understandable and desirable to youngsters.[16]

ABOUT TECHNOLOGY

Somehow the school has to get a handle on the one major phenomenon of the era which it fails to make intelligible — technology. Efforts to make contemporary extensions of man's senses, i.e., machine and tool systems, meaningful have been piecemeal and scattered. Unlike exact scientists, engineers and other of their ilk have not insisted that the secondary schools do the foundation pieces of their dirty laundry. This is well in the sense that meaningless and disassociated bits of material about technology are not presented with anywhere near the frequency as are those from the liberal arts and sciences. There is more than the proverbial Chinaman's chance that meaningfully integrated content about technology and its impact on man will be left to professional educators (we hope new kinds of industrial arts educators) to organize and present in the schools.

If what is called industrial arts education is ever to make technical matters intelligible to children and youth, its leaders must devise a scheme or schema for arriving at pedagogical lumps of teachable stuff. That is, leaders in industrial arts teacher education and curriculum must come up with a method of cutting the technological pie into digestable pieces. Something at least as good as algebra-geometry-trigonometry-calculus must be used to assure units of instruction which teachers, publishers, equipment manufacturers, administrators, parents and kids can comprehend and digest.

Educators have not heretofore attempted to categorize content about technology for other than stricly utilitarian purposes. There are a great many educational programs in the engineering, industrial and medical technologies,

[16]Samuelson, *op. cit.*, pp. 46-47.

but there are very few schema for organizing content about technology into teachable units for general education or pre-specialized occupational education purposes.

One such categorical system seems worthy of description. It appears that content about technology can be subsumed under the following headings: energy conversion and power transmission, materials and processes, visual communications, and electronics and systems. These are broad categories which are certainly not mutually exclusive but do have rather distinct boundaries. They result in manageable units of content and represent aspects of technology which are emerging, i.e., aspects of technology where invention, discovery, and innovation make for excitement, challenge and change.

All human or machine activity incorporates each of the four at some level of sophistication. A given activity, such as the generation of coherent light or the manufacture of knowledge and energy pills, may utilize one more than, but not to the exclusion of, the others. All manners of endeavor employ some form of power, some material and process, some communication with machines or people, and some form of control which increasingly incorporates electronics and computers. Even the simplest human activity employs the four technologies. When prehistoric man hunted, he used (1) visual communications in several forms to alert members of the work team, (2) several materials and several processes to camouflage himself and his implements to snare or wound his prey, (3) his own and perhaps simple energy conversion and power transmission devices, e.g., crossbow or blow-gun, and (4) his own central nervous system which served as the guidance and feedback control circuit for his relatively simple performance. Man in highly mechanized endeavors, such as space travel or petroleum refining, is surrounded by visual communication systems, materials and processes in motion, several interrelated energy conversion and power transmission systems, and very complex guidance and other closed loop and open ended control circuits. The four technologies are patently evident in manufacturing, construction, office work, and elsewhere in the world of work. Although they are ubiquitous, they are not understood by those who have not studied them in schools or colleges.

Visual Communications

Visual communications makes understandable the exchange of ideas, beliefs, and data in the whole of society and within and between all manner of enterprises. A systematic examination of visual communication is essential to those who would comprehend the world around them and participate intelligently as workers and consumers. A study of visual communications must have as its basis a concern with how vital message production systems and mass distribution systems are planned, organized, directed, and controlled in productive society. The design, selection, production, and distribution of all manner of communiques in industry, trade, business, and other

segments of society are essential for study. Those who would make enterprises in the economic system understandable to children and youth need to know much more about the technology of communications and the communication process itself than does the typical contemporary graduate. Because no significant work, anywhere in society, is begun, culminated, or evaluated without some form of visual communication, it is essential that the many media be studied for the general purposes of occupational education.

Materials and Processes

The study of materials and handcraft methods for employing same in useful objects has been the mainstay of industrial arts. Many programs assure familiarity with many traditional materials and supplies in the broad areas of woods and metals. But even in these areas, most programs do not make functions and characteristics of modern materials known to youth. The diversity of materials used in secondary and tertiary manufacturing, food processing, construction, banking and other aspects of the economy suggests that education is harmful to children if they are not made aware of the contemporary technology of materials and processes. Content courses in teacher education should allow investigation of the many processes which are used throughout society to process materials. Learning activities should center around the numerous processes which are utilized in the procurement of raw materials, for collection and transformation of primary materials into intermediate forms, and for purposes of research, construction, manufacture, production, and service. Moreso than previously, instruction needs to be given at the conceptual level so that teachers and students will understand the materials and processes which are important in contemporary productive society and did not exist in the craft era.

Energy Conversion and Power Transmission

The development and refinement of efficient prime movers and power transmitters aid and abet all manner of enterprise. History illustrates that productivity is closely allied to the development of power sources, energy converters, and effective utilization of motive force. Some amount of the future teacher's study must be directed toward an understanding of energy conversion and power transmission systems. The major units of such study should be direct converters, electromagnetic converters, heat pumps, turbines, thrust engines, internal combustion engines, fluid power and mechanical transmission systems. These and their impact on technology and occupations are worthy of the efforts of students who would understand man and his world.

Electronics and Systems

The study of electronics and systems, including computers and cybernation, is important to anyone who wishes to understand contemporary affairs. Teachers and, in turn, their students should be aware of electronic and computer control systems in medicine, communications, public media, religion, manufacturing, and other segments of society. Subsystems such as power suppliers and amplifiers, circuits such as plate circuits and grid circuits, and components should be studied in that order. At each level the significance of input, control and processing, and output should be treated. Everyone should understand electronics and computers, and the industrial arts teacher should be very familiar with same. How computers serve accounting, guidance, production control scheduling, and many other functions should be understood by everyone.

ABOUT ENTERPRISES

In addition to the study of human, financial, and technological aspects of productive society, teachers need to understand working units in the world of work. Because there are a great many of these, only a few can be studied in detail. The best that teacher education or the schools can do is to familiarize students with several dimensions which pierce the world of work and several samples of enterprises along these dimensions.

Some important dimensions are: (1) size of organization, from the small, local firm which employs a limited number of workers to the large corporate enterprise which employs thousands of workers; (2) degree of mechanization, from the organization which produces custom goods or services to the organization which mass produces goods on continuous, highly-automated production lines and seldom redesigns products; (3) type of institution, e.g., financial, governmental, religious, educational, recreational; (4) degree of vertical integration with reference to primary, secondary, and tertiary operations; (5) degree of horizontal integration with reference to diversity of goods and services produced; (6) major materials, e.g., rubber, metals, plastics; (7) major processes, e.g., mining, data processing, communication, casting, repair; (8) major products, e.g., automobiles, appliances, toys, missiles. These are only a few of the ways organizations which produce goods and services may be classified. One could easily devise several useful systems of classifying firms by location alone.

Obviously, the diversity of enterprises requires that commonalities rather than specifics be the significant parts of the content of instruction in teacher education — to date, relatively insignificant manipulative skills have been the major components of instruction. Principles which make for efficient combinations of money, men, machines, materials, and methods should be illustrated via classroom, laboratory, homework and other experiences. How these major resources are utilized in all manner of enterprise is the primary thread, the most significant concept, which industrial arts must illuminate.[17]

To understand how the major resources are combined, future teachers will need to conduct model enterprises after the fashion of Junior Achievement companies. Designing, financing, organizing, staffing, controlling, and

[17]Brown, *op. cit.*, pp. 97-123.

evaluating a small but real segment of the ongoing economy must be done by students in teacher education — and school children — if they would understand primary units in the world of work.

The conduct of an enterprise should form the core of experience which may be aided and abetted by a variety of reading, classroom, field trip, and other experiences. Future teachers should be conversant with value engineering, work sampling, operations research, industrial relations, marketing, etc. General and unique characteristics of contemporary enterprises should be examined. Systems design, materials handling, production planning and control, plant location and layout, purchasing and transportation — these and many more specialized functions should be understood. Principles in the broad areas of finance, design and development, procurement, production, and distribution should be treated. Some of the specialties which can contribute to a curriculum which would make enterprises understandable are: marketing research, product selection, product design, process design, plant location, plant layout, purchasing, inspection, storage and warehousing, stores control, materials handling, traffic, safety, production control, work simplification, time study, motion study, cost control, operations research, quality control, job evaluation, personnel selection and placement, training, industrial relations, wages and incentives, packaging, marketing and sales, and advertising.[18]

Readings will need to be selected and organized with caution because very little appropriate literature has been prepared for modern occupational teacher education programs. Students must be encouraged to read industrial biographies, i.e., narratives about the growth and subsequent development of corporations, businesses, and agencies which have played prominent roles in the formation of productive society. Appropriate and indeed exciting stories abound concerning the development and growth of IBM, Sears, J. C. Penney, Sony, Swift, General Motors, Boeing, and others. The biographies or autobiographies of prominent American enterprisers, i.e., Ford, DuPont, Carnegie, Massey, Norge, DeSoto, and Kettering should be required fare for future teachers.

Other *homework* should consist of endeavors related to continued planning and evaluation of enterprise activities in which the student will actually employ the concepts gleaned from classroom and library experiences. Such endeavors might involve the formation, planning, and organization of a mass production experience in the laboratory. This would involve the development of production schedules, flow charts, organizational charts, inventory sheets, requisitions, and other planning activities. For others this might involve record keeping or evaluation of production and other activities.

Frequent *excursions* to numerous business, industrial, or governmental agencies can contribute much to a student's understanding of the world of

[18]Armine, *op. cit.*, Section I-V.

work. Students will need close supervision and much guidance in developing a plan to aid and abet awareness and understanding of a food processing plant, oil refinery, drug store, restaurant, or automobile repair shop. Trips to various enterprises will add to the knowledge of the department store and chemical plant which may have been achieved in elementary school and will extend understandings developed in classes on the campus.

Provisions must likewise be made for prospective teachers to obtain *cooperative work experience*. Individuals who would teach about the world of work must have worked in other than educational enterprises. Some exposure to effort in a mine, mill, cannery, bakery, furniture factory, bank, or whatever is very important. Classroom and laboratory experiences can never be as true-to-life as actually breathing coal dust, scaling logs, pumping gas, operating a press, and punching a time clock. Every effort must be made to close the gap between what the world of work is really about and what is done in educational institutions in the name of occupational, technical, or industrial arts education. One way to assure compliance with reality is to arrange cooperative work experiences for summer employment of teacher education students and practicing teachers.

Laboratory activities should incorporate representative, sample enterprise experiences which foster student understanding of the inter-dependence of specialized work tasks for efficient production. Prospective teachers must learn the principles involved in the design of a salable product or service. They must also learn to arrange for financial support of the endeavor through the sale of stocks or bonds or by the acquisition of a loan. Subsequent experiences would involve preparation of appropriate tools, dies, or fixtures, equipment rental, procurement of supplies, selection and training of a work force (students), production of the goods or services, distribution of such items, financial reporting, and evaluation of activities.

Laboratory experiences can be as simple or as difficult as is deemed necessary by the many variables which impinge upon the educational situation. Every effort must be made to impress the fact upon students that school experiences are only representative of what actually occurs in business, industry, and commerce. This fact will be more readily understood because of cooperative work experience. Students should be required to participate in a variety of jobs in laboratory enterprises so that they will understand levels of responsibility, the role of the supervisor, the need for policies and procedures, the pressures of production, the profit motive and other characteristics of the private and public sectors of the economy.

Laboratory experiences should be selected with extreme care so that a variety of learnings occur. Enterprise activities may include bookkeeping services for student accounts, baby sitting services, contracting for custodial, delivery, laundry, or landscaping services, assembly and packaging of merchandise or both for department or hardware stores, operation of concession stands at school athletic and social events, and many others.

ABOUT THE EDUCATIONAL ENTERPRISE

The world of work and technology has obvious major implications for the preparation of professional educators. Succinctly put, the enterprise of education must come of age. It must make full use of differentiated staffing and technology. No curriculum project will be so significant as is the trend toward more specialized work tasks and greater utilization of technology in classrooms, laboratories, and offices in the educational enterprise.

The teacher of the 70's will be a classroom-laboratory supervisor rather than a classroom lecturer or shop foreman. He will be a leader of a team of specialists consisting of professional educators, instructional specialists, softwear and hardware technicians, and other para-professionals. He will be charged with duties of a supervisory nature. His primary duties will be to assure that (1) appropriate materials are selected, (2) learning experiences are appropriately spaced, (3) quality educational standards are achieved and maintained, and (4) expenses are kept to a minimum.

In future, the educational enterprise will demand that teachers be able to plan, organize, direct, coordinate, and control the efforts of the instructional team. Complex man-machine systems consisting of highly competent subject matter specialists, para-professionals, and complex technology, including computer controlled systems, will aid and abet instruction. The competencies of a variety of professionals and para-professionals will be shared with students. Computers will be programmed to store, retrieve, and present voluminous quantities of pertinent information. Students and staff alike will have access to remote computer terminals for quick retrieval of desired information.

The time is past when the teacher can be the sole director of classroom endeavors. The teacher-supervisor will direct a team of specialists who will introduce concepts, give instruction at the level of detail employing advanced educational technology, and evaluate student progress. Prospective teachers must be exposed to modes of planning and decision making which were previously studied by masters of business administration and engineering majors and few others. The study of systems analysis or system planning for educational management and supervision will add a new dimension to the quality of American education.

"Cost benefit" or "cost effectiveness" analysis is already a part of this more sophisticated approach to decision making. It includes methods of arranging ends and means so that decision makers possess clearer pictures of the numerous alternatives open to them. It entails improved ways of evaluating results in light of predetermined goals and performance standards.

Systems planning should be an integral part of the preparation of classroom-laboratory supervisors so that they may

(1) pay deliberate and careful attention to alternative procedures,
(2) expend greater effort on the formulation of detailed instructional plans, and
(3) make more systematic comparisons of methodologies, evaluation specialists and learners themselves.

Instead of the usual pseudo-philosophical fare, so-called professional courses need to stress educational planning and management. Students must be made aware of the numerous factors which influence the attainment of educational goals. Students must become familiar with educational policies, procedures, rules, and workers in the classroom-laboratory, and the numerous lesser aspects which impinge upon the educational effort. Prospective teachers must have training in the principles which govern long-term planning and daily routines. In-depth study of scheduling techniques is essential because schedules will be much more complex than they are now. Occupational education teachers will be required to possess skills and knowledges which will enable them to plan activities in light of stated objectives not in terms of what students want to make in the laboratory.

Professional educational experiences must develop organizational abilities which will enable tomorrow's teachers to arrange and balance activities of the educational team for maximum effectiveness. Such persons must be schooled in the fundamentals of human relations in work. They must possess the ability to delegate tasks to individual team members. Teacher education students who would supervise professional teams must develop the ability to deploy instructional software and hardware and auxiliary personnel to serve the purposes of individuals and groups.

This will require a more mature teacher than has heretofore been graduated. Characteristics of leadership will have to be much more in evidence in teacher-supervisors than they now are in teachers. Some of these characteristics are: conscious of standards, dependable, courageous, good delegator, innovative and imaginative, straightforward, self-disciplined, idealistic and visionary, good at human relations, good communicator, good judgment.[19]

In teacher education considerable effort should be expended toward improving communications skills. A teacher's effectiveness as a classroom-laboratory leader is dependent upon his prowess as a communicator. He must possess the ability to communicate precisely and forcefully so that desired behavior results. This ability might better be fostered by some of the kinds of courses which are required of business management majors. It will certainly require more graduated and extensive internships than the traditional stint of student teaching. It will probably require full-time work for some number of months at each of several lower levels on educational teams.

[19]Ronald W. Stadt, "Characteristics of Leadership in Utilitarian Education," *Journal of Industrial Teacher Education,* 4:4-7, Summer, 1967.

The classroom-laboratory supervisor should participate in professional experiences which develop skills in controlling instructional effort. Such skills should enable teachers to analyze time requirements, maintain quality instructional standards, inspect and evaluate instructional activities, and reduce educational costs. Emphasis should be placed on maintenance of quality standards at lowest possible cost. Tomorrow's classroom leaders must become aware of the salient characteristics of various cost control systems. They must, likewise, become more knowledgeable regarding all aspects of costs within their immediate realm of responsibility.

CONCLUSION

Industrial arts teacher education has never encountered so many forces of such great magnitude as those it now confronts. At once, technology impinges upon work, school, and student. Information processing and other developments, together with changing interpersonal relationships in the world of work, have major importance for those who would direct the efforts of students who would understand same. Content changes in industrial arts must be as rapid and frequent as possible, but major changes in the process and technology of instruction must be introduced if learning is to be compatible with the foreground of the student's world, and if the educational enterprise is to keep pace with other elements of productive society.

Contemporary material about the labor force, technology, and major segments of the economy will do much to assure our place under the sun; but because the rate of change in much of the out-of-school world is astronomic, approaches to pre-specialized occupational education must concentrate its efforts upon commonalities about the organization of men, money, materials, and machines for the production and distribution of goods and services. General understanding and acceptable attitudes rather than specified units of content and work skills should be the intent of such programs. Industrial arts should assume responsibility for informing youth and ill-fitted adults about contemporary work and technology. If man is to be other than slave to his creations, he must be intelligible about the human and the technological sides of enterprise. These must be studied in concert— this is the charge for industrial arts. Much of the technology and the characteristics of men at work which make our challenge so great may be employed to meet that challenge. What we would have the young learn in school, i.e., technology and the human side of enterprise, should also characterize the educational enterprise.

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