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ABSTRACT

The literature on vocational education indicates a number of factors that have shaped the need for a change in the vocational education system. These factors include Japanese industrial pressure and philosophy, technological advancements, a shortage of skilled workers, and a mismatch between available jobs and trained workers. Suggestions to improve the vocational education curricula are customized training and generalized training. Two sample curriculum designs have been developed that employ the present trends of generalized training in vocational education--Core Curriculum and Principles of Technology. Improved vocational education strategies could play a key role in improving economic and industrial problems in the United States for several reasons: (1) such programmatic changes could provide better preparation for manual and skilled labor; (2) vocational education has a direct effect on the labor force and economy; and (3) jobs requiring vocational training top the list of occupations with pressing placement demands. A recent study has measured students' opinions of their current vocational/technical education and determined their beliefs about the importance of current trends in vocational education. Findings indicate that students perceive a need for considerable change. On items pertaining to trends, there is strong support for more interdisciplinary and communication skills training. (YLB)

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Student Perceptions of Vocational Education

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INTRODUCTION

Participants at the National Conference on Technological Assessment and Occupational Education in the Future (1980) concluded that vocational education was the key for a U.S. industrial recovery. They proposed that the vocational education system should 1) become partners with the private sector in order to develop a trained, employed, and productive workforce; 2) assist in re-industrializing the United States at every junction of the process; and 3) become an integral part of the economic development strategies of states, regions, and localities (Leach, 1982).

The purpose of this paper is three-fold: 1) to review the literature on vocational education, emphasizing factors that have contributed to change and recommmended improvements; 2) to obtain a representative student assessment of the present state of the vocational education system; and 3) to determine students' feelings about the importance of current vocational education trends.

FACTORS THAT HAVE SHAPED THE NEED FOR A CHANGE IN OUR VOCATIONAL EDUCATION SYSTEM

1. Japanese Industrial Pressure and Philosophy. In 1978, the world experienced a devastating energy crisis that caused fuel prices to soar and industrial production to slow to a crawl, except in Japan. Japan had anticipated this crisis, engaged in protective measures, and went on to experience an industrial boom. Within a few years, the U.S. became a major importer of fuel, steel, and autos, instead of a major exporter.

Why was Japan able to achieve this, even though they were ranked higher than the United States in overall cost in manufacturing products (15% more) (Elliman, 1983)? The answer lies in Japan's industrial attitude. In Japan, a strong aura of trust exists between worker and employer; this, in turn, leads to a high sense of cooperation, efficiency, and a production rate eight times higher than the United States.

Also, the Japanese take pride in their work, and there is a strong sense of respect for all levels of employment, from dishwasher to the president. This sense of pride and respect is evident in the fact that in Japan, the job turn-over rate is minimal (once a Japanese person enters a corporation, he/she is there for life). However, in the United States, the job turn-over rate is 60% after a two year period.

Possibly because of these characteristics, the Japanese were able to maximize their resources and minimize their production costs. This enabled the Japanese to become highly successful in the competitive international marketplace. The U.S. is just beginning to realize that our self-centered attitudes have hurt us economically, and to recognize the potential of the Japanese industrial philosophy for our own country.

2. Technological Advancements. In the past ten years, technology has been advancing at such an astronomical rate, that even industry is having a difficult time in "keeping-up" with the changes. Updates on equipment occur so often, that within a few years, equipment becomes obsolete and useless. Advancements in technologies, such as lasers, fiber optics, computers, and robotics, are having their greatest effects on biogenetics, information technologies, energy related industries, and manufacturers (Lewis,1985).

A major problem plaguing industry is that technology is becoming more highly complex. Machines that once used simple mechanical processes, now involve multiple, inter-related, highly technological principles. (This concept is hard to illustrate; but if you compare a computerized car engine of today with one from 30 years ago, the difference becomes quite clear). On the other hand, the good news is that new technology is not really destroying jobs, so much as altering them (Pelletier, 1983). However, to fill these new jobs, highly trained technicians are needed that possess a more comprehensive background to operate, maintain, repair, and adapt the equipment to the existing work place (Hull, 1985).

The new "breed" of technician will require more complex and in-depth training. According to Daniel M. Hull, President of the Center for Occupational Research and Development (CORD), the "new" technician will require a diversified knowledge, an orientation to problem solving, responsivity to change, and a willingness to retrain (1985).

He believes that Vo-tech students should learn why, as well as how, something works. They should know the principle as well as the tools and procedures of their jobs.

3. Shortage of Skilled Workers. The advancements of technology have led to the third reason why our vocational education system needs to change: a shortage of skilled workers. This shortage started in the Post World War II/Depression Era. During this time, people were scared of a second depression and, to seek some form of security, began flooding college to earn degrees. This gradually led to a decline in people entering "blue-collar" jobs. Afterwards, negative parental attitudes toward traditional vocations became prevalent. Children were discouraged from pursuing a vocational education, and were led to view it as "the easy way out" or "a second-hand, dead end education".

Today, the shortage of skilled workers is alarming. In the The Forecasting of Manpower Requirements, a publication issued by the Department of Labor, a serious shortage of people in sub-professional jobs (technicians, lab assistants, etc), crafts persons and skilled office machine operators is predicted. This report anticipates that in coming years, a large number of useless skilled and semi-skilled workers will flood the labor market.

4. Mismatch Between Available Jobs and Trained Workers. The reason why a mismatch between available jobs and trained workers developed is simple: technology grew and employers' needs changed, while vocational training remained stagnant. Since the introduction of vocational education, its main purpose was to train craftsmen and assemblers, for these were the jobs that were in the most demand. As technology grew, assemblers and craftsmen were replaced by robotics and computers; thus the demand for these people declined. At the same time, the need for engineers, technicians, and operators increased. However, vocational programs did not adapt to then changing needs.

The American Vocational Association (AVA) partially blames this mismatch on the government. According to the AVA, the critical mismatch between workplace needs and worker's skills would not exist to the extent that it does today if Government policies over the past decade had placed some emphasis on hard-to-fill jobs rather than focusing all efforts on hard-to-train jobs.

This mismatch indicates a serious communication problem between industry and vocational education systems. Industry failed to inform vo-tech schools about their requirements, and vo-tech schools never bothered to ask manufacturers what kind of trained professional they would be needing in years to come. Mechanisms for improving mutual planning are obviously necessary.

WHAT HAS TO BE DONE TO IMPROVE OUR VOCATIONAL EDUCATION SYSTEM

Many suggestions have been proposed regarding the improvement of our vocational education system. One idea has been to return to a "no-nonsense", strictly academic curriculum for the first twelve years of schooling (Silberman, 1983). Some believe that traditional academics are the key to the future for vocational education. Other researchers have proposed a "double work-load" for vo-tech students, requiring them to have the same academic track as non vo-tech students and a full technical training program. This would be accomplished through a lengthened school day and a longer school year (Knight, 1983). Unfortunately, such a heavy work-load would probably further discourage people from attending vocational school, thus making matters worse. These approaches, however, fail to address the need for true substantiative curricular change in vocational educational programs.

More innovative proposals for change suggest ways of restructuring the old system instead of merely building upon it. This long-term philosophy involves improvements that would more carefully relate employment and training programs to the occupational structure. For these long term improvements, many vocational educators have turned to industries and manufacturers for help.

Because of the direct influence vocational education and industry have on each other, this decision to work collaboratively was wise. Manufacturers have suggested that vocational education needs to cater to two fields: 1) the manufacturers of high tech equipment; and 2) the large and small industries that use such equipment (Ruff, 1981).

Basically, four major themes have emerged from suggestions made by manufacturers.

-provide specific training in cooperation with industry.
-improve and expand prerequisite training, allowing industry to teach specifics.
-upgrade and update existing programs.
-retrain displaced workers to adapt to more flexible circumstances.

CORD took this idea one step further and developed criteria for the ideal high-tech technician. This "Bionic Technician" would possess seven characteristics.

1) The ability to apply and use the basic principles of physics and technology.

2) Develop a facility with mathematics including the ability to use algebra, trigonometry, and analytical geometry as problem solving tools. An understanding of higher mathematics--including computer languages and some calculus may be required.

3) The ability to analyze, troubleshoot, and repair systems that are composed of subsystems in three or more of the following areas: electronics, electrical, mechanical, thermal, fluidic, and optical.

4) Develop a facility in the use of materials, processes, apparatus, procedures, equipment, methods, and techniques commonly used in the technology.

5) A knowledge of the field of specialization with an understanding of current engineering applications and industrial processes in the field.

6) Develop a facility in the use of computers for information management, equipment, and process control, and design.

7) Communication skills that include the ability to record, analyze, interpret, synthesize, and transmit facts and ideas with objectivity--orally, graphically, and in writing (Naylor, 1985).

Applying these suggestions to the vo-tech curricula can be done in two ways: customized training and generalized training. In customized training, the less popular of the two, vocational education systems tailor their programs to the needs of a given specific industry. In this approach, vocational schools would work directly with particular industries. With such an arrangement, all sides benefit: industries get exactly what they need in workers, schools do not need to spend top dollar for state-of-the-art equipment, and the community benefits from the economic prosperity that is generated by the presence of the company. The National Center for Research in Vocational Education at Ohio State University is a strong advocate of customized training. They feel that such an approach would be most productive in the long run (Braden, 1979).

However, customized training has its drawbacks. Such a vocational education still produces a narrow-minded and limited skilled worker. If a student has trained himself to work at one specific job for a certain company, he would have a very difficult time finding a new job if he ever left that original company.

The more popular approach in re-structuring the vocational education curriculum is through generalized training. Many researchers suggest using this strategy because its application is universal to all industries. Generalized training teaches basic, transferable vocational and technical skills, and then lets industry teach the fine points (Elliman, 1983). According to CORD, emphasis should be placed on instruction about underlying principles of technology. It is no longer adequate to teach just how machines work; students must comprehend why they work. Technology is becoming more and more complex, and in order to understand it, a technician must have a firm grasp on the theories behind the machinery.

Generalized training should also involve more interdisciplinary education. Today, machines employ multiple physical principles (such as fluidics, thermodynamics, electronics, etc.) in their operations; it is becoming increasingly important for technicians to be fluent in more than one discipline.

CORD has developed two sample curriculum designs that employ the present trends of vocational education: Core Curriculum and Principles of Technology. The Core Curriculum developed from the idea that in the curricula needed to teach the ten main technical fields, over two-thirds of the courses are common to all fields. All technical students can be taught a broad-based "core curriculum"; and then later on in their education, the students can branch-off into specialized technical fields.

The Core Curriculum is based on two sections: a common core and a specialized core. The common core consists of two parts. The first part is the base core, which involves mathematics, science, communications, computer literacy, and socioeconomics courses; and the second part is a technical core involving electricity and electronics, mechanics, electromechanics, materials, fluids, thermics, graphics, controls, and computers. The second section of the Core Curriculum is the specialization core. This part ensures that the student attains a level of expertise in a chosen high-tech specialization.

The idea of the Core Curriculum's design is to give the technical student a strong theoretical background as well as a concentration in a particular field. This will enable the student to retrain and redevelop his/her skills as technology grows and expands.

Principles of Technology is a physics and applied science course designed to meet the needs of the vocational technical student (Principles of Technology). It is designed around the idea that "students who are interested in pursuing vo-tech programs in high school and postsecondary institutions are frequently disinterested, unwilling or incapable of learning abstract, theoretical subjects that do not appear relevant to their life and work.

Principles of Technology's goals are to:

- Provide an understanding of the principles of technology and the mathematics associated with them.
- Help students adapt themselves continually to the work force and its changing demands.
- Use an appealing, effective instructional system that includes audio/visual presentations, tests, demonstrations, and hands-on laboratories.
- Meet some of the increasing science requirements for high school graduations (A New Role p.9).

The Principles of Technology course consists of 14 units of instruction, each consisting of 26 lessons of 50 minutes each. Each unit deals with a particular principle as it relates to different aspects of fluidics, thermodynamics, mechanical processes, and electrical principles. Each unit involves lectures, hands-on labs, video programs, written assignments and demonstrations.

WHY VOCATIONAL EDUCATION CHANGES WILL FOSTER ECONOMIC RECOVERY

Improved vocational education strategies could play a key role in improving economic and industrial problems in the U.S. for several reasons.

1. Such programmatic changes could provide better preparation for manual and skilled labor. Since the establishment of the vocational education system, its main purpose has been to train people for the job market. In the past, vocational education has provided measurable standards and quality education in the craft area, reduced the time of experiential learning, and infused safe practices and attitudes. Building on this system's track record seems an efficient way of meeting our current, pressing needs for labor training.
2. Vocational education has a direct effect on the labor force and economy. Vocational education programs train potential workers. Then, when these workers receive their certification, they enter the job market, increase the skilled labor pool, and eventually alter the economic character of the region (Braden, 1979). In other words, when a person graduates from a vocational program he/she becomes a member of the labor force, and eventually becomes an economic contributor to the region he/she works in.
3. Jobs requiring vocational education training top the list of occupations with pressing placement demands. Over three-quarters of the jobs in the United States require technical training and there is a growing need for trained technicians in fields such as digital technologies, computerized design, manufacturing, robotics, etc. Vocational education is already geared to train people to fill these jobs. It would make no sense to remove such training from this firmly established system.

EMPIRICAL RESEARCH

The research involving this topic is fairly recent, and the proposals for vocational education curriculum changes are largely theoretical at this point. The only proposal to be experimentally tested thus far involves the Principles of Technology approach. In 1984, Principles of Technology was taught to 25 machine shop students at a technical high school in Alliance, Ohio. At the completion of the first year of the course, the students took the High School Achievement Test. The results were very promising: the class averaged in the 95th percentile in science and in the 90th percentile in math (Hull, 1985).

Currently, Principles of Technology has been released to 65 sites in Canada and the United States. However, a telephone discussion with Ron Kimberling of the Center for Occupational Research and Development in Austin, Texas, revealed that no data concerning its effectiveness is currently available (personal communication, March, 1988).

Another study was conducted by the National Association of Manufacturers (NAM) and the National Center for Research in Vocational Education at Ohio State University (1982). The intent of their survey was to elicit the views of NAM members about vocational education--the effectiveness of vocational education, the collaborative activities between manufacturers, and manufacturers' suggestions for improvement of vocational education (Nunex and Russel, 1982).

The results of the NAM survey corroborated opinions previously reviewed in this pape. The majority of the manufacturers felt that the teaching of basics and the underlying scientific principles was essential, thought that more involvement of industries was essential, and believed that the instruction of employability skills and job skills was essential (pp 11-15).

Out of the roughly 800 surveys returned by NAM members, the most frequent grade given to vocational education was a "C" (no mean was available for this data). This suggests that considerable room for improvement is perceived.

METHOD

In the present study, 600 questionnaires were distributed among six vocational technical high schools selected as representative of each of the six national accreditation regions. Initially, the principal of each school was contacted by phone to solicit agreement to participate (there were no refusals). Principals were later requested to randomly distribute 100 questionnaires to seniors at their school. Student participation was anonymous.

The self-report questionnaire was designed to measure students' opinions of their current vocational/technical education and to determine students' beliefs about the importance of four current trends in vocational education, emphasized by CORD (interdisciplinary training, basic science foundation, computer literacy, and communication skills). The trend items each consisted of two 7-point Likert scales, one assessing perceived need and one reflecting current educational experience. The questionnaire also assessed various demographic variables.

RESULTS

Of the 600 questionnaires distributed, 265 (44%) were returned, representing four of the six states involved in the survey (California, New Jersey, Vermont, Kentucky). The overall grade most frequently awarded by students in evaluating their vocational education program was a "B" (114/215 responses) and the overall mean was 2.89, which is roughly a "B-". The mean was calculated in the same manner a university would calculate a Grade Point Average (A=4, B=3, C=2, D=1, F=0).

With regards to the students' opinion about what changes should be made to improve the quality of their program, the most frequent response (27.5%) suggested a choice for greater work experiences outside of the classroom. Roughly one fifth of the students perceived a need for more different kinds of vocational education programs and updated programs, and 18.1% of the respondents urged placement efforts. Only a minority endorsed greater stress on basic English and communication skills (7.8%), and placing more emphasis on math and sciences (5.1%).

A majority of the respondents (84.6%) felt that teaching both employability skills and specific occupational skills was essential in preparation for the job market. However, only 72.2% felt that their vocational/technical school was meeting this need.

Means and standard deviations were calculated for all trend items. (interdisciplinary training, $x = 4.33$, s.d. = 2.78; basic science foundation, $x = 3.74$, s.d. = 3.06; computer literacy, $x = 4.32$, s.d. = 4.11; and communication skills, $x = 4.42$, s.d. = 2.91). Scores on perceived need for interdisciplinary and communication skills training were significantly higher than ratings of current program provisions for these trends ($t = 3.23$ and $t = 3.42$, respectively; $p<.05$). Student ratings of perceived need for greater emphasis on the basic sciences were only marginally higher than their ratings of their program's emphasis in this area ($x = 3.74$ versus $x = 3.40$; $t = 1.97$, $p<.05$). There was no significant difference between perceived need and current program provisions for computer training.

DISCUSSION

These findings indicate that students perceive a need for considerable change in their vocational/technical education programs. It's not surprising that foremost in their minds are educational components which will help them to land jobs. Students desire greater work experience outside the classroom and employability skills training.

On the items pertaining to trends, there was strong support for more interdisciplinary and communication skills training. However, students did not favor more emphasis on math and sciences nor more basic English courses. It seems that while in principle students reccgnize the importance of a broad-based education, it is harder for them to commit themselves to the specific work necessary to achieve inter-disciplinary competence. This resistance could reflect the failure of teachers of traditional high school math, science, and English courses to convey the relevance of their course content to the more applied interests of this type of student. These findings suggest that merely inserting traditional courses into the vo-tech curriculum will not achieve desired objectives. Instead, there is a need to reformulate basic science and English courses with the specific needs and preferences of this special student population.

The one area where students report that programs have been fairly successful in meeting a new educational need involves computer literacy. Apparently many curricula have already been modified to incorporate important changes related to this technology.

Although these results suggest some student awareness of the trends in vocational technical education identified by CORD, it is interesting to note that the item means were all close to the median scale value of 4. Apparently students are far from strongly convinced about the needs for greater interdisciplinary training, computer literacy, and improved communication skills training. They feel that study of the principles underlying physics and mathematics is not an important part of preparation for today's job market.

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