DOCUMENT RESUME

ED 039 759 | 56 | EM 008 095

AUTHOR Swanson, J. Chester
TITLE Instructional Technology in Service to Vocational-Technical Education.
INSTITUTION Academy for Educational Development, Inc., Washington, D.C.
SPONS AGENCY Office of Education (DHEW), Washington, D.C. Bureau of Research.
BUREAU NO BR-8-0571
PUB DATE [70]
NOTE 24p.; This is one of the support papers for "To Improve Learning; a Report to the President and the Congress of the United States by the Commission on Instructional Technology", ED 034 905

EDRS PRICE EDRS Price MF-$0.25 HC-$1.30
DESCRIPTORS *Instructional Technology, *Technical Education, *Vocational Education

ABSTRACT

The potential of our present technological devices is almost beyond our imagination. The actual use is insignificant by comparison with the potential, but it is significant in amount of effectiveness. The following suggestions, it is hoped, will help realize some of that potential: 1. Publicize the success stories of instructional technology; 2. Encourage experimentation; 3. Make more funds available for these types of instructional activities; and 4. Evaluate them so as to establish any financial advantages or significant instructional effectiveness. (Author/GO)

INSTRUCTIONAL TECHNOLOGY IN SERVICE TO VOCATIONAL-TECHNICAL EDUCATION

by J. Chester Swanson*

Neither the term Vocational-Technical Education nor Instructional Technology has been standardized to the extent that it clearly defines a limit of action or a body of content which is uniformly accepted. The following definitions will be used in this discussion.

Vocational-Technical Education is an organized educational or training experience whose objective is to develop skills and provide knowledge related to a specific employment opportunity.[1]

This is a rather narrow definition in that it does not include many activities which support vocational education activities and in some instances are essential to its effective operation (e.g., industrial arts, basic education--the three "R's"--guidance, counseling, placement, etc.). Vocational education will be further delimited by not including education for professional

* J. Chester Swanson is director of project, Program for Research and Development in Vocational-Technical Education, School of Education. University of California at Berkeley.

[1]This definition conforms with the definition of vocational education given in Public Law 90-576, Title I, Part A, Section 108, the most recent Federal legislation for vocational education.

occupations which normally require the baccalaureate or a higher degree.

This definition is broad in that it includes instructional and training activities in public and private schools--secondary, post-secondary and adult levels--and in business, industry, government and the Military. It includes work-experiences, apprenticeships, and internships as well as formal school programs. The terms "vocational" and "vocational-technical" will be used interchangeably. The hyphenated term is normally used to emphasize the fact that vocational education includes instruction which requires extensive knowledge and skills in mathematics and science.

Instructional Technology is defined as the use of any device of a technical nature in the learning-teaching process or in the ancillary activities which serve the student, the teacher or the administrative process of vocational-technical education,[2] (e.g., visual aids, auditory aids, computer scheduling, computer-assisted instruction, etc.).

---

[2]This definition in general conforms with the description of instructional technology given by Robert Heinrich in "What is Instructional Technology?", Audiovisual Instruction, March 1968, pp. 220-222.

This definition is more narrow than what might be developed from an etymological consideration of the Greek word from which "technology" is derived. This discussion shall consider only instructional processes related to machines, devices or instruments. The devices will be considered important only as they are related to the process of instruction.

Vocational-Technical Education is unique in its relation to Instructional Technology because much of vocational education is a process of teaching manipulative skills in the use and/or maintenance of technical devices. Thus much of vocational education is performed in an environment of technological equipment. This means that the vocational teacher is often very skillful in the production of technical equipment, in the knowledge of its operation and in the purpose of its use. The use of such devices by vocational teachers in the instructional process becomes very natural.

In any discussion of vocational education the great diversity and scope of its instructional programs must always be kept in mind. The following selected list of vocational programs in the high schools of California is given to illustrate this diversity.

Agricultural Production	Dental Technician
Accounting	Welding
Aviation Pilots	Computer Programing
Meat Cutters	Embalmers
Watch Repairmen	Electronic Technician
Food Service	Police and Fire Service
Locomotive Engineers	Printing
Nursing	Automotive Repair
Merchandising and Sales	Beauty Operators
Secretarial and Office	Commercial Artists

There are more than two thousand different courses in vocational education in the public schools of California. This diversity makes it relatively easy to find some program for which any specific instructional technology would be appropriate and is possibly in use. It also makes it quite difficult to make statements on, or imply general practice or applicability to, vocational education.

The Uses of Technology in Vocational Education

Technology in the instructional process of vocational education is quite old and has been extensively used. This statement might be illustrated by such examples as (1) the use of the record player to set a rythm for the teaching of typewriting; (2) the use of "mock-ups" as operating models of mechanical and electrical equipment; and (3) the use of the filmslide and opaque projectors for presenting perspectives in mechanical and architectural drafting.

As more "software" became available--if this term can be used for projection-type equipment--with subject matter related to vocational practices, the use of the traditional and simpler audio-visual equipment increased at a rapid rate. During World War II many training films and filmslides were developed to assist in the instruction of skilled and semiskilled persons for war production and military training. A number of commercial firms greatly expanded their production of both audio-visual devices and the program materials for these devices during this period. After the war this production capacity and "know-how" was directed toward school and industrial use. Vocational teachers took advantage of these materials.

The "mock up" or display board showing in graphic form the parts and relationships of machinery, devices or operations developed into simulated devices which became working models for teaching purposes. Thus the flow of air in pneumatic devices, the flow of electrical currents in electrical circuits, and the motion of movable parts in machinery became observable in wall charts. This development of simulation devices became so sophisticated that a device for pilot training (the Link Trainer) was developed which significantly shortened the training period and improved the safety factors. The military developed many such devices in their extensive automation of instructional aids. Public schools, with few exceptions, do not have the financial capability to purchase, develop or operate such technical aids to instruction.

Moving-picture projection is used in many programs where training films are available--but relatively few are available. Television is used infrequently because few video tapes, films or live programs are available and because the listening-viewing audience is usually too small to justify the use of such expensive and limited facilities.

The Military has used closed-circuit television extensively as part of its basic training. They have had the financial ability and the number of students to justify its use.

The device which has grown in use most recently has been the continuous film loop projector. This is an inexpensive, small, simple to operate, sound (or silent) moving-picture projector which is threaded with a cassette of 8 mm. closed-loop film. One cassette provides several minutes of picture. These films can be produced locally. For many courses, any teacher could with reasonable financing develop a major part of his course material for individual instruction. The use of this type of equipment is increasing extensively.

Much of the audio-visual technical equipment has been considered in the past to be best used to reach large audiences. It now appears that the major use of technology may be to individualize instruction. The closed-loop film described above is a good example of such use. The video tape recorder with auxiliary equipment would do the same thing but at many times the cost and necessitating a trained operator. Various types of teaching machines have been suggested for use in individualizing instruction for vocational students. None of these machines is in general use. If materials were developed for these machines, some could be widely used and be within the cost limits. Magnetic card readers could also be used in such a manner.

Vocational instruction is being extended to reach more students. At the high school level many programs are being developed as basic courses for related groups of occupations. These developments may require the provision of courses for large numbers of students and thus make feasible the use of mass media devices. During the development of such conditions the technological problems are the same as for any instruction--the availability of the programed material on film, tape, etc.

<u>Technology as course content</u> is a much more distinguishing feature of vocational-technical education than is instructional technology. Technology as course content may have more effect on vocational instruction than on any other instructional program. Instruction in electronic technician, computer programmer, electromechanical technician and medical technician are becoming quite extensive and are all courses resulting from extensive automation and mechanization of business, industry and household devices. The design, production, operation and maintenance of equipment for automated and mechanized processes require persons with more extensive skills and knowledge than has been traditionally demanded. Learning these skills often requires also more time and more maturity than secondary students possess. The result has been a rapid expansion of vocational-technical enrollments at the post-high school level.

Technology as course content does not present any unique problem for vocational education. It may require more expensive equipment than other programs and for some occupations it becomes impossible for the public schools to provide the necessary equipment. At times such instruction is provided as a "cooperative education" program where the skill training is provided by industry or business while the basic knowledge, related education and some of the field supervision are given by the school.

Technology in the management of instruction is probably the most important contribution of technology to vocational education. Technology is now being used in a number of institutions to assist in the scheduling for vocational instruction. The results of at least one research study[3] and the reports of institutions which have used computers for scheduling indicate that the use of such devices has proven very helpful but that their use for vocational instruction is not appreciably different from that for academic instruction. At the present time in most schools the number of classes and number of students do not make computer scheduling necessary except in relation to a large academic enrollment and the resulting complex class schedule.

Some schools are now using computers with auxiliary equipment to make certain types of information readily available. Such data retrieval systems are well known in business and industry and only the costs of installation,

---

[3] Allen, Dwight W., Flexibility for Vocational Education through Computer Scheduling. Research contract No. OE-2 CAD-570-94, U. S. Office of Education and Stanford University 1966-68.

maintenance and operation prevent these systems from being much more widely used. Data retrieval systems could serve vocational instruction very effectively in the following ways:

1. Provide job description information with recent labor market data.
2. Provide evaluative information--placement data, enrollment trends, "follow-up" data on graduates.
3. Provide financial data--budget items, budget trends, unit costs, unit cost trends (maybe, in time, cost benefits).

These data would be available from the local, state and national levels and would be provided as appropriate to students, faculty, counselors and administrators.

Impediments to the Use of Technology in Vocational Education Instruction

The financial capability of vocational education is limited. Vocational instruction is in general more costly than academic instruction, due to greater equipment and supply needs and to smaller class size. These higher costs do not always prevail, since some non-vocational programs are very costly and some vocational classes are large and do not require expensive equipment. The competition for funds does prevent the operation of many vocational programs and also restricts major expenditures for existing programs. These factors greatly limit the extensive use of newer technological devices in the instructional program.

Federal funds have subsidized vocational instruction in public schools since 1917. Until 1963, however, no Federal funds could be used for equipment. In the first year in which Federal funds could be used to purchase equipment, some states spent the major part of these funds to replace, expand and update their vocational instruction equipment.

The President signed into law in October 1968 a new Federal law for vocational education. This law has the potential for providing almost $18 for every one dollar provided by the Federal government before 1963. Most of these funds must be matched on a 50/50 basis. There are severe problems in many public schools in the purchase of expensive equipment even on a basic subsidy of 50%. These additional Federal funds, however, will have a significant effect on the use of technological aids in instruction.

Certainly, a major impediment to the use of technology in vocational education programs is limited finances.

The additional Federal funds will help. If school administration and instructional supervision were to increase its interest in such programs more money would be available. The focus on youth unemployment may create a growing concern for expanding vocational enrollment and developing more expertise in making this instruction effective. These factors would increase the use of instructional technology. The original cost, the operating costs and the maintenance costs are major factors in vocational instruction.

Walt Disney reported on one occasion that he organized the Disney Enterprises to produce educational films for schools. He said he had learned two facts in regard to educational films: (1) that schools did not have the funds to buy a significant number of films; (2) that if you didn't tell the public the films were educational, they would pay to see them as entertainment.

The physical environment is a factor in vocational education's use of technological devices. Often these devices require unique or quite exacting specifications for the acoustical and visual environment. If the technological devices are to be used to reach larger-size classes effectively, then larger rooms or more auditoriums are necessary. If these devices are to be used for individuals or for very small groups, then cubicle or alcove type spaces are needed, and usually these are not available. Some devices, particularly television, require unique electrical wiring, such as coaxial cable. If major computer equipment is used, air conditioning becomes necessary.

These problems related to the physical environment are in general no different for vocational than for academic instruction. However the noise level and the nature of shop buildings may make it more difficult and expensive to create optimum environmental conditions. Unless certain minimum conditions are available some technological types of instruction cannot be provided.

<u>The logistics of technical devices</u> often greatly impede their use, at times completely blocking their effectiveness. It seems unreasonable to say that technical devices cannot be available in the right place at the right time and in operational condition. Very few teachers have not had a projector and no film, film and no projector, or projector with burned-out bult create a very frustrating classroom situation.

The writer observed a condition in which 5,000 radios were given to the public schools in the Philippines with a powerful transmitting station. This equipment was to be used to improve the program of instruction in the Philippine schools. Since most schools in the Philippines did not have electricity these radios were battery radios, using automobile-type storage batteries. Most of them were never operational past the first two weeks because it was never practical to recharge the storage batteries. Technology solves this problem, not logistics--transistor radios with disposable batteries replaced the originals. This particular situation did not occur in the United States but such types of situations do impede technology, and administration for many reasons cannot always prevent them.

Teachers who experience such difficulties may soon cease to include such devices in their teaching plans. As technological aids become more sophisticated, the logistic type of problem becomes more significant. Computers cannot operate without a very special type of cord or tape. Operators are necessary since only rarely could a teacher program or operate the equipment. Related to the logistic type of problem are certain fears of the use of devices.

<u>The human element</u> in working with equipment becomes very important. Some very competent teachers have mechanical aptitudes that end shortly beyond the use of a ball-point pen. Studies have shown that a large proportion of the language laboratories which have been installed are not used extensively and that the reason is the teachers' fear of the "gadgetry," or feeling of insecurity in its operation. Technical developments will solve some of these problems by making the operation automatic. Other situations will be solved by using equipment for which a trained operator must be available.

Another aspect of the human element in instructional technology is the psychological effect on the teacher. Some students of this phenomenon have asserted that the teacher, who has traditionally and historically had complete control of the teaching process, now feels that he is controlled by an automaton, a "thing," that tells him when to start teaching, where to do the teaching and what content to cover in any teaching period. The teacher then no longer is the <u>master</u> of the situation but more nearly the <u>slave</u> of a system. Such a situation would be an impediment to a teacher who either consciously or unconsciously reacted in this manner. This condition will not be considered in this paper.

Probably the most important human factor impeding the growth of instructional technology is lethargy. Any new process takes energy and time and creates uncertainties. It is much easier, much more secure, to continue in the methodology which the teacher has developed and used in the past. Good administration and supervision can overcome much of this apathy but it must be recognized in the planning stage.

The vocational teacher is as subject to the lethargy "virus" as the academic teacher. However, the vocational teacher in general has much more mechanical aptitude.

There may be many other human factors which impede such instruction now or may do so in the future. One condition has been discussed considerably in recent years. This is the problem of royalty rights. Some teachers have resented and resisted having their classroom practices and content reproduced on film or tape. It would appear, however, that the practice is relatively little different from publsihing teacher-created materials. The problem will be readily solved as creative rights are protected by law and by accepted practice. This situation might be considered as a new type of problem resulting from technological developments.

Observations and Suggestions

Technological devices and processes should be used much more extensively to improve vocational-technical instruction. The following suggestions attempt to "spot-light" vital needs and programs which are within reasonable financial limitations.

Individualized instruction via the continuous loop moving-picture projector, the magnetic card reader, the tape recorder, the programed teaching machine, is easily adapted to vocational instruction. The biggest problem in this instructional technology is the "software" or the content for these devices. Vocational instruction is so diversified and the number of students so small in most courses that it is impractical for commercial firms to produce such materials. The solution is for the Federal funds available to vocational education to subsidize the production of these continuous loop films, magnetic fact cards, audio tapes and programed materials.

Commercial companies with Federal contracts could produce such materials. Or state and university curriculum centers could devise the content and process, and the commercial firms produce the final product.

The more popular high school vocational programs, with the larger number of students, should be produced first--courses such as basic electricity, the automobile (chassis, engine, body and automatic devices), typing, shorthand, merchandising, etc.

Studies should be made to enable the teacher in his own school to produce much of this material. The individual teacher using cassettes can now readily produce taped materials. Equipment is easily possible that the teacher could use to produce much of his own 8 mm. continuous loop film material.

Large group instruction can be made more effective and more efficient by the use of TV (video tapes), radio (audio tapes), and projection equipment. These devices, like those in use for individualized instruction, are not more widely used because of the lack of program materials--film, tapes, etc. They have not been produced extensively by commercial firms because of the cost and the relatively few students in any one subject matter area. The proper solution in this case is to segment the content material into modules and then produce the modules for which there is a large enough demand. Educational television stations should be forced to devote some of their day-time hours to ITV for schools. Some of this should be vocational.

Larger school districts should operate their own TV stations with both live and taped programs. Such programs might be multi-class materials. For instance, certain lesson productions in electricity, gasoline engines, physics, chemistry etc. might be of value to vocational, general science, physics and probably other classes. The teacher in his follow-up would make the adaptation to the particular class. Scheduling between schools is a real difficulty but such mechanical problems can and will be solved when the program is vital enough.

The normal vocational teaching situation can be enriched and made more vital by technology. The materials for both individual instruction and large group instruction can assist in normal-sized class instruction. The additional assistance provided to individual students by such methods may make it possible for many students who formerly became failures to keep up with the class. This additional assistance might help considerably in striving for a "zero-reject" situation in student achievement.

The visual and auditory presentations and the material presented can do much to enrich and bring into the classroom that which clarifies and motivates the learning process. When it is practical to bring to the classroom the type of presentation that Walt Disney visualized, learning will more nearly be the ecstasy that is pictured in a recent magazine.[4]

Recently a situation was observed in which a typing teacher wore a "wireless" microphone in a classroom with 80 students. There were six microphones installed throughout the room. The teacher reported she could hear any pupil in the room and she could speak to the class from any position. She stated that she could serve the 80 students better than she formerly had served 35 students. This was the idea of a teacher with the assistance of a vocational electronics class. The potential for ingenuity in teaching by the use of technical devices is vast and the results might be phenomenal.

Ancillary services may use technology in the most significant ways to vocational instruction. Demonstratinns are now rather common of the use of computers for information retrieval. It is easily possible at the present time to dial for vast amounts of information and obtain an auditory response, a projected visual response or a typewritten response. The costs are high for investment, operation and maintenance. However where large numbers of students and teachers are involved it may be practical to use these now. The costs certainly will decrease in the years ahead. A major use of such a device would be

[4]Leonard, George B., "Learning Can be Ecstasy," in Look Magazine, September 1965.

in vocational counseling where current data could be fed in at a state or large regional area and made available to students and teachers who normally could not have access to such information.

Computer-type devices should be used in the evaluation process. Some vocational tests--aptitude and achievement--are now available on programed learning type programs. Many tests should be developed as a means of determining aptitudes before placement in training, and as achievement tests for termination of training or placement in employment. Some of these types of programs are now in use in state employment services.

The simplest, most common and oldest use of the computer is for data processing and tabulation. Very much more needs to be done in vocational education. The most recent national statistics for vocational education are 18 to 24 months old and errors and inconsistencies are easily detected. All state departments of education should record their operational data on tape or cards for rapid tabulation, analysis and print-outs. Many of the decisions required of administration would be much more easily and accurately made with more recent and complete data available.

State and Federal governments are demanding more complete and recent data for legislative actions. One type of data often requested is student "follow-up" data: What is the employment experience of vocational education students? Computers should be programed to request such information at regular periods and record, tabulate and analyze the results. This activity should be performed by all large school districts and by the state for all other schools. There should be certain nationally accepted standards so that data from the various states would be compatible.

The demand and need for unit costs of vocational instruction are increasing each year. Such information has traditionally been impossible or impractical to secure. The procedure is now possible and practical. Some school districts are now pro-rating and programing all expenditures so that determining unit costs and program budgeting can be a routine practice.

Conclusions

The potential of our present technological devices is almost beyond our imagination. The actual use is insignifcant by comparison with the potential, but yet is significant in amount and effectiveness. It is a temptation to boldly predict radical and immediate changes. Many have:

> Mr. Edison said in 1913, "Books will soon become obsolete in the schools . . . It is possible to teach every branch of human knowledge with the motion picture. Our school system will be completely changed in ten years."[5]
>
> Dr. George Zook, a U. S. Commissioner of Education, described the motion picture in 1940 as "the most revolutionary instrument introduced into education since the printing press."[6]
>
> Dr. Thomas C. Pollock of New York University in 1957 said, "It now seems clear, however, that television offers the greatest opportunity for the advancement of education since the introduction of printing by movable type."[7]
>
> A recent book (1967) states that "The impact of the computer on society, and hence on curriculum, has been compared to that of movable type and the printing press since Gutenberg."[8]

At least, all these prophets gave recognition to the printed page. It would seem however that many of the recent technological devices may have to "hang around" for

[5] Dramatic Mirror, New York, July 13, 1913.

[6] Hoban, Charles F., Jr., Focus on Learning, American Council on Education. p. 16.

[7] from Stoddard, Alexander J., Schools for Tomorrow: An Educator's Blueprint, The Ford Foundation. p. 27.

[8] Caffrey, John and Charles J. Mosmann, Computers on Campus: A Report to the President on their Use and Management, American Council on Education. p. 12.

about as long as the printing press in order that some of these prophesies be realized. It is to be hoped that means can be found to help vocational education reach the full potential of technological instruction much sooner and more effectively than has been true of other educational innovations. The following suggestions might be made toward such a goal:

1. Give visibility to the present achievements of technology in instruction--disseminate its success stories.

2. Encourage experimentation and pilot-type activities and their support services.

3. Make more funds available for these types of instructional activities.

4. Evaluate all such activities and obtain evidence as to any financial advantages or significant instructional effectiveness.