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ABSTRACT

Both the rapid movement to the knowledge/imagination age and a more thorough understanding of how problem-solving skills are developed challenge traditional education to change and adopt a new set of goals. Academic and vocational education are modifying their goals and instructional procedures, and they are blending together. As technology has evolved, the nature of work and preparation for work has changed. Tracking students into college preparatory, vocational, or general programs is not sensible now, when the nature of work does not have one group of individuals directing work and another group conducting the procedural aspects of work. In the modern workplace, the nature of much work has changed; separating those who implement the procedural aspects from those who design, supervise, and direct the work is difficult. Given this changed context for work, the Secretary's Commission on Achieving Necessary Skills has identified generalizable skills required in most workplaces as a basis for preparing people for employment. In response to such new life and workplace requirements, the educational community has defined a set of Criteria for the New American High School. Tech prep and the Southern Regional Education Board's High Schools that Work are two exemplary reform programs that ensure that all students have a rigorous academic background, develop technological literacy, and have realistic experiences in real world environments as contextual references for their learning. (YLB)

The Changing Roles of Vocational and Academic Education In Future High Schools

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The Changing Expectations of Education

As we move into the 21st century the dichotomy between academic and vocational education is disappearing. Both academic and vocational education are being forced to modify their goals and instructional procedures which are causing them to blend together.

The pressure for the reform of high school education is one being felt around the world. This is due primarily to world societies moving from the information age into the knowledge/imagination age. It is also due to the realization that in order for a society to be productive all of its people must be well educated. It is no longer reasonable to educate the most educable and to pay less attention to the rest. This evolution is requiring all people to have a rigorous academic education that they can apply to life and work, as well as an understanding of the rapidly developing technologies that they will encounter during life and work. It is no longer sufficient for individuals to just accumulate information; they must be able to convert information into knowledge that they can apply in imaginative ways.

Applying information in imaginative ways is another way of saying that students should be able to use information to solve problems. In recent years it has become clear that creative problem solving is contextually based. This means that in order for a person to solve a problem in a domain of activity the person must first be somewhat familiar with that domain. For example, a person can not creatively solve food preparation problems without first having some understanding of the elements that go into food preparation. A person can not solve manufacturing problems without at least a minimal understanding of the tools and technologies of manufacturing.

It is also clear that most learners are concrete learners. This means that they have difficulty taking abstract concepts and applying them to real situations. Therefore, educators must not only teach content but they must show how that content is applied in the real world if students are going to be expected to use that content in the future.

Therefore, if a goal of schooling is to prepare students to enter life and work and to be able to creatively problem solve, all future students must have a command of both academic competencies and technologies that are associated with their future career and life interests. This requires them to be both technologically literate and academically literate. One must not confuse technological literacy with computer literacy. There are many different technologies associated with life and work, such as systems technology, construction technology, engineering technology, health technology, and manufacturing technology. Technological literacy means "...the possession of understandings of technological evolution and innovation, and the ability to apply tools, equipment, ideas, processes and materials to the satisfactory solution of human needs." (Pucel, 1994;1995c) Therefore, students must be provided opportunities to develop broad-based technological literacy as well as academic literacy.

The Changing Nature of Work

As technology has evolved, the nature of work and preparation for work has changed. It is no longer possible for societies to prepare one group of people to be thinkers and another group to carry out the procedural aspects of work. In the past, it has been assumed that some students should be prepared through college preparatory programs for leadership and intellectual roles in society, some should be prepared through vocational programs to carry out procedural aspects of work, and the remaining students should at least be prepared to be sufficiently literate to be able to function as productive citizen within society. Therefore, high schools organized their programs

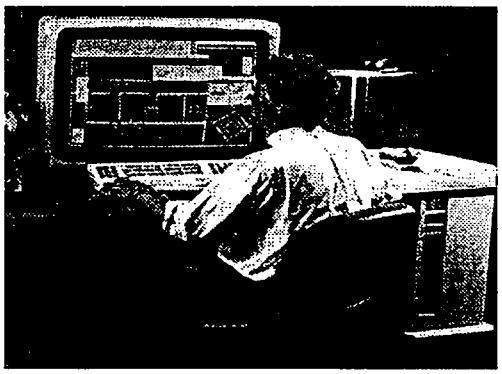
around these three expected life goals. They developed a college preparatory program, a vocational program, and a general education program. The college preparatory track was to provide an abstract education in the arts, science, mathematics, and social sciences to prepare students for further study in college. The vocational track was assumed to require a less rigorous background in academic subjects and more education in the concrete skills associated with specific occupations. The general track was assumed to generally prepare student for life with no specific focus. (Conant, 1967)

In the past, this made sense because the nature of work as presented in picture 1, often had one group of individuals directing what work would be done and how it should be

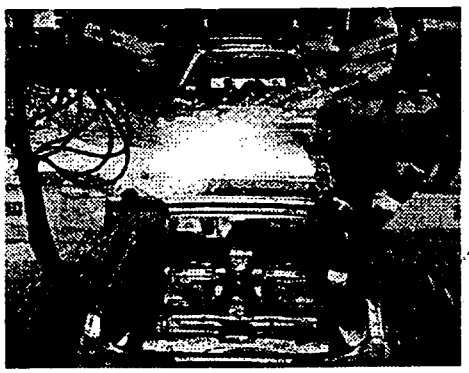
Picture 1
The Old View of Work and Workers

done, and another group actually conducting the procedural aspects of work. As picture 2 depicts, the nature of much of the work that takes place today in the modern workplace has changed and it is difficult to separate those who are actually implementing the procedural aspects of work from those who are designing, supervising, and directing the work. Many of the repetitive procedural aspects of work are being done by technology as presented in Picture 3. And even if workers are expected to complete procedural aspects of work, they are being asked to be more involved in working with others, directing their work, and designing systems to carry it out.

Picture 2
The Word of Today and the Future



Picture 3
Work and Technology



Given this changed context for work, in 1991 the U.S. Secretary of Labor undertook an effort to identify generalizable skills required in most workplaces as a basis for preparing people for employment (SCANS, 1991). A broad-based committee of people from business and industry and a wide variety of disciplines was assembled to consider the skills that would be needed by all individuals who enter the workplace of the future. The list of skills, known as the SCANS skills (Secretary's Commission on Necessary Skills), are exemplary of those also developed by Canadian government and the American Society for Training and Development as well. They are presented in Table 1 below.

Table 1
SCANS Skills

Three-part Foundation:

Basic skills: Reading, writing, arithmetic/mathematics, listening, speaking.
Thinking skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn, and reasons.
Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, integrity and honesty

Five Competencies

Resources:	Identifies, organizes, plans, and allocates resources.
Interpersonal:	Works with others.
Information:	Acquires and uses information.
Systems:	Understands complex inter-relationships.
Technology:	Works with a variety of technologies.

(U.S. Department of Labor. June 1991)

The skills are divided into two portions. The first is a three-part foundation of skills that are considered to be those needed in order to carry out five major competencies. The three-part part foundation includes the basic skills of reading, writing, mathematics, listening, and speaking. It includes thinking skills including problem solving, visualizing, knowing how to learn, and making decisions. It also includes personal qualities such as taking responsibility, self-esteem, self-management, integrity, and honesty. The five competencies include the use of resources, interpersonal skills, using information, understanding how systems work, and the ability work with variety of technologies.

Implications for Changing High Schools

In response to such new life and workplace requirements, the educational community within United States has defined a new set of criteria for what it considers to be a quality American High School. Again a broad-based advisory group was assembled. This time by the U.S. Department of Education to create criteria for the ideal American high school. Those criteria are listed in Table 2. They address the need for all students to achieve high levels of academic and technical skills. Notice that this includes technical skills as well as academic skills. It is envisioned that these goals would be accomplished by teaching students within the context of career majors or special interests. The group believed such education would also require students to have learning experiences beyond those possible within the school classroom. Therefore, it recommended that all students have real experiences in workplace or other community-based settings as part of formal schooling. They also indicated that students should have hands-on experience with applying what they learned as well as intellectual experiences. They believed that this education should prepare all students either to go on to

Table 2
Criteria for the New American High School

- Help students achieve high levels of academic and technical skills.
- Teach students in the context of a career major or other special interest.
- Offer hands-on learning - in classrooms, workplaces or community service.
- Access a wide range of career and college information.
- Prepare students for college and careers.
- Work with teachers in small school-within-schools.
- Win the support of a caring community.
- Receive extra support from adult mentors.
- Benefit from strong links with postsecondary institutions.
- Use technology to enhance instruction and learning.

(Vocational Education Weekly, 6/3/96)

further education or directly into careers. There is a growing belief that if students can anchor their education to future life goals which they perceive as important, they will be more highly motivated to learn and their ability to actually apply what they learn in high school to life and work environments will increase.

By examining the SCANS skills and the criteria for the New American High School, the need to re-structure high school education becomes clear. The challenge for educators is to develop a revised curriculum and new methodologies for implementing that curriculum, which are consistent with these new expectations.

Within the United States changes are incrementally being made and evaluation systems are being put in place to ensure that all students have a rigorous academic background, develop technological literacy, and have realistic experiences in real world environments as contextual references for their learning. Although there are many educational reform activities underway, two such exemplary reform programs will be discussed further. They are the work of the Southern Regional Education Board (SREB), and the schools within each of the United States and territories that are participating in the Federally funded Tech Prep programs. The Southern Regional Education Board is a superboard created by the governors of the 13 southeastern states of United States. (Bottoms, Pucel, & Phillips, 1997) It was formed to cooperatively upgrade the educational systems within those states. Tech Prep programs in each of the states and territories are expected to develop applied curricula focused on developing rigorous academic skills and technological understandings in the context of career areas. (Brustein, 1993) These programs are expected to be cooperatively developed by consortia of at least one higher education institution and surrounding high schools with the cooperation of business and industry.

Common elements of these reform movements are:

1. The high school curriculum should require applied learning.
2. The high school curriculum should teach creative problem solving.
3. The high school curriculum should be integrated. (This means that vocational teachers and academic teachers should do joint planning to ensure that all students receive a rigorous academic preparation and develop technical skills and understandings associated with a career major.)
4. The high school curriculum should be articulated with that of post-high school educational institutions. (This means that high school program planning should be done in cooperation with post-high school educational institutions to facilitate a smooth seamless transition of students from high schools into higher education and the world of work.)
5. The high school curriculum should be designed to allow all students to participate in community-based activities as part of their formal schooling.

Changes in Curriculum Practices

In order to achieve these reform expectations, curriculum planning and pedagogical practices in the classroom have had to change. For example, academic teachers in my home state of Minnesota are expected to plan the theoretical content they will teach and an applied application of that content as part of each lesson plan. Vocational teachers are expected to teach the theoretical content underlying the career applications they are going to teach. In many cases this has forced academic and vocational teachers to plan together.

As the expectations for all students to have a rigorous academic education and an understanding of technologies associated with an envisioned career area have increased, the role of high school vocational education has changed. The primary goal is no longer to prepare students with a sufficient set of skills to directly enter an occupation. That role has been moving to postsecondary education.

At the high school level the function of vocational education is to provide students with experiences with career activities associated with their career interest. This requires students to participate in realistic career activities designed to acquaint them with the SCANS skills and technological literacy defined earlier in the context of their career major. This requires schools to develop laboratories and facilities to provide hands-on activities with real activities that are similar to those practiced in careers in the world of work. Although some skills developed could be transferred to the world of work, the range of skills provided not be sufficient to prepare most students for direct entry into occupations. In some cases specialized high schools might be needed to prepare some students for direct entry into the world of work, but that is not the primary role of comprehensive high schools which would be attended by most of the students.

More concentrated training in specific occupations would be provided later at the postsecondary level. Students leaving such training would be able to directly enter the world of work or go onto additional education for more advanced education. Once students become employed, the business or industry that employs them would provide them with additional training in the unique methodologies of that business.

Conclusion

The rapid movement to the knowledge/imagination age and a more thorough understanding of how problem solving skills are developed has caused major groups in society to challenge traditional education to change and to adopt a new set of goals. If countries are to remain competitive in the New World economy, they must re-design their educational systems to meet the new requirements of their society. More specifics on how to revise the high school curriculum can be found in The Changing Role of Vocational Education and the Comprehensive High School (Pucel, 1998).

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