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ABSTRACT

As American society has changed from the industrial age to the information age to the knowledge/imagination age, the notion of a comprehensive high school in its originally envisioned form has again become a high priority. If all students are required to obtain a rigorous academic education and an applied education related to a life or work interest, they have the opportunity to change their minds about future life goals and instructional programs as they move through high school. Changed expectations have led to a major movement to teach academic basics in a more functional manner around real-life applications and to ensure that career preparation programs are focused on the broad range of skills required in the workplace. Vocational education can no longer prepare students for direct entry into the world of work as skilled workers in a highly technological society. States are designing educational systems that provide specialized occupational preparation at the post-high-school level. To modify vocational education to meet new expectations, major concepts that affect curriculum design have been evolving: career majors, career activities, applied instruction, project-based instruction, integration, and articulation. Changes in vocational education curriculum practices are course goals, course content, who should deliver instruction and how it should be delivered, and evaluation of vocational course achievement. Steps in developing the new career major curriculum are to determine a school's career majors and sample careers within each major and to identify which courses to include. (Contains 21 references and sample career majors.) (YLB)

The Changing Role of Vocational Education and the Comprehensive High School

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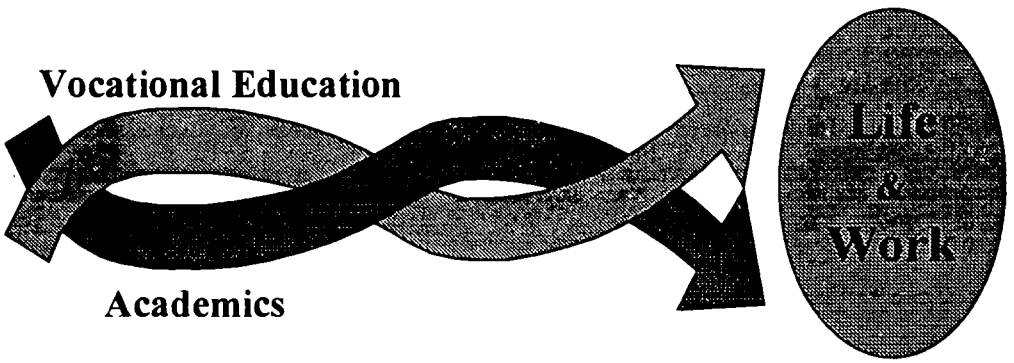

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Preface

This paper was developed to describe the evolving role of vocational education at the high school level within the context of societal change and total educational reform. It also provides a description of the evolving roles of the comprehensive high school and academic education with which the evolution of vocational education must interface. The paper begins with a general description of societal change and its implications for academic and vocational education and continues to get more specific in terms of the development of a new high school curriculum. The paper ends with a discussion of some of the major critical issues that must be debated and resolved as curriculum reform progresses.

The Comprehensive High School

The role of vocational education in the United States and the comprehensive high school are based on democratic principles. This has a dramatic impact on how they have been implemented in the past and how they will be implemented in the future. The character of the comprehensive high school can be summarized in the following quote from John Gardner.

> "The comprehensive high school is a peculiarly American phenomenon. It is called comprehensive because it offers, under one administration and under one roof (or series of roofs), secondary education for almost all the high school age children of one town or neighborhood. It is responsible for educating the boy who will be an atomic scientist and the girl who will marry at eighteen; the prospective captain of a ship and the future captain of industry. It is responsible for educating the bright and the not so bright children with different vocational and professional ambitions and with various motivations. It is responsible, in sum, for providing good and appropriate education, both academic and vocational, for all young people within a democratic environment which the American people believe serves the principles they cherish." (Conant, 1967, p. 3)

The comprehensive high school historically has been based on an elective rather than a selective system of education. Students have been allowed to choose the type of curriculum they wish to pursue. Even when separate vocational schools have been established in the United States at the high school level, they have been viewed as a continuation or complimentary component of the comprehensive high school.

As compulsory school attendance laws were put in place in the United States the heterogeneity of the student body attending high schools increased. This heterogeneity was viewed as an advantage of the public high school because it brought boys and girls from different environments together and they got to know each other. The comprehensive high school "... endeavors to provide a general education for all future citizens on the basis of a common democratic understanding; and it seeks to provide in its elective offerings excellent instruction in academic fields and rewarding first-class vocational education." (Conant, 1967, p. 4)

Although the goals of the comprehensive high schools stated above have remained, the actual structure of programming in the schools eventually evolved into three tracks; the college preparatory track, the general track, and the vocational track. Although students could choose the type of education they wished to pursue, once they embarked on a particular choice, their ability to widely choose amongst the many curricular offerings in the schools was severely limited based on which track the student chose. Most often tracking was not done consciously, it happened based on the nature of course selections students made early in their high school careers which provided them, or did not provide them, with prerequisite courses needed to progress in other courses in the future.

The tracks also evolved because of great differences in perceptions of the type of education students needed to fulfill different life roles. Those who wished to go on to college were perceived to require an abstract education in the arts, science, mathematics, and social sciences which prepared them for further study in college. Those who wished to go directly from high school into the world of work were perceived to need a less rigorous background in the academic subjects and more education in the skills associated with the occupations they wished to enter. Those who wished neither an academic or vocational focus to their education took courses as part of the general track. The general track was viewed as preparing students for life with no specific focus. Although these curricular tracks evolved, many of the basic premises of the comprehensive high school continued to be achieved. Students from throughout the school jointly took part in some common classes, they participated in athletic events, band, school clubs and other activities. Therefore, the goal of students from different social environments interacting and getting to know each other was a reality.

In some of the larger cities separate vocational schools were established. They were often established for instructional efficiency reasons. The equipment required to supply vocational schools to meet industrial age requirements was very expensive and took a large amount of space. Vocational schools that served an entire city were able to serve students from many different high schools. Later, this concept was expanded during the 1970s and 80s to a new type of school typically called a secondary vocational center. Secondary centers were established to serve multiple school districts based on the same logic as a separate vocational school in a large city. Small school districts were not able to supply the types of vocational education needed to prepare students to directly enter jobs immediately after high school, therefore, they joined together and provided opportunities for their students to obtain specific skill training through the secondary centers. The Federal government and many states began to embark on the development of secondary centers. However, this movement is now in rapid decline and many states are eliminating their secondary vocational centers.

It is important to realize that the rational for separate vocational high schools, and later secondary centers, in the United States was not the same as the rationale underlying separate vocational schools in Europe. Students were not tested and based on their test scores assigned to different types of schools as they were in Europe. The notion of the comprehensive high school as contrasted with the European system of establishing completely separate academic and vocational high schools has been justified based on American social and political ideals. (Conant, 1967, p.4) In the United States students attended vocational schools based on selecting a vocational curriculum as being more compatible with their life goals. Therefore, even though separate vocational schools might have been established to more efficiently provide vocational education programs, they were not established to promote a separation of those who were less academically inclined from those who were academically inclined.

As American society has changed from the industrial age to the information age and later to the knowledge/imagination age, the notion of a comprehensive high school in its originally envisioned form has again become a high priority during the 1990s. The general

principles of students being able to freely elect courses from the total set of courses in the curriculum versus tracking, and the need for all students from all social environments to interact with each other have again become paramount. This is occurring at the same time that the perceived educational requirements needed to prepare students to enter adult society are changing. There is an increasing belief that structuring the curriculum so academic instruction is primarily a basis for further academic instruction, and vocational education is primarily focused on a limited set of academic of academic skills and more highly focused on procedural skills to prepare students for direct entry to work, does not serve students or society well. There is also an increasing belief that the general track, which does not provide students with either what they need to go on to further education or the world of work, should be eliminated. Therefore, American education and the view of the curriculum in the comprehensive high schools are in the state of reform. Those reforms are being driven by new visions of future society and associated educational requirements. However, most of the basic tenants of the comprehensive high school and its democratic ideals are continuing to be the basic foundation for educational reform.

Basic Concepts Underlying Current Educational Reform

The reform of the comprehensive high school and education in the United States is being driven by an increasing consensus in beliefs about how education should be designed and delivered. The author has synthesized these belief into the following six major concepts.

Major Concept 1

- Society has changed dramatically since 1917 and the advent of Smith-Hughes vocational education in the United States.
- Vocational education and academic education must adapt to the changes in society in order to be relevant.
- This means that the expectations for academic and vocational education at all levels: middle school, high school, post high school must change.

Major Concept 2

- Applied learning motivates students.
- Problem solving and creative imagining are context based.
- Students should each have a vision of how their education relates to their futures that can provide a context for learning.
- The major dimensions of students' futures relate to life and work.
- Therefore, each student should develop a program of studies around their vision of their life and work, which they may change as their visions change and evolve.

Major Concept 3

- Curricula in schools should be planned to implement and facilitate alternative student visions.
- Curricula can be planned around career and life clusters of occupations or roles.
- Career majors that include vocational and academic courses can provide starting points for students to develop their individual programs of studies.

Major Concept 4

- Students should be able to experience real-world situations related to their visioned career and life major.
- Schools should establish vehicles to allow students to gain planned learning experiences in the community.

Major Concept 5

- All students should have a solid foundation of academic skills.
- All students should have realistic experiences with the technology and the sociological and economic contexts of their particular career area.
- Vocational education and academic education are equal partners in providing an integrated set of both types of competencies.

(The use of the word technology here does not refer to solely computer technology. Technological Literacy in a career area requires the possession of understandings of technological evolution and innovation in an area and the ability to apply tools, equipment, ideas, processes, systems and materials in the area. (Pucel, 1994, 1995c)

Major Concept 6

- Vocational education is more than an applied learning methodology for the teaching of academic content.
- Vocational classes should be responsible for providing all students interested in a career path with realistic experiences with the technology and the sociological and economic contexts of careers.
- Vocational education and academic education have content bases of their own which are essential to achieving today's high school educational objectives.

The New Context of High School Education

The industrialized countries of the world have moved from the industrial age, to the information age, and beyond to what some are calling the knowledge/imagination age, and this has created a need to revise the vision and practices of high school education. The relationship between societal change and educational change is not new. The role of education in society has been and continues to be essentially the same. "Basically education in all societies aims at orienting the individual to his (her) social and physical environment." (Frost, p. 8) As those environments change, it is reasonable that the nature of education should change. In a time of relatively little societal change, educators tend to address questions focused on how to do what they have been doing better. They develop benchmarks and expectations against which they judge good practice. However, in a time of major societal change, past benchmarks and expectations must be adjusted. This situation is analogous to the impact of changing technology on the types of ships we have. The goal of ships continues to be to carry people and cargo across the seas. For centuries wind power was the driving force of ships. Therefore, ship makers spent their time concerned about how to trim the sails, how sails should be mounted, and how hulls should be design in order to get more wind-powered speed. Then all of a sudden, steam power came along and it no longer made a difference how sails were trimmed. There was no longer a need for sails. What was really needed was to refine and develop a different kind of ship. High school education, and particularly vocational education, is now facing a similar situation.

The recent calls to change the educational practices within comprehensive high schools began in the early 1980s with the back to basics movement. The 1983 Carnegie report, A Nation at Risk (Carnegie Foundation, 1983) suggested the desired change was to ensure all students had quality basic academic skills. In response, curriculum reform began to emphasize academic education, and vocational education and practical arts programs were devalued and downsized in many schools. As this movement progressed, educators and the public began to realize that the type of academic education that had been focused primarily on college prep students did not meet the needs of the majority of students. It was highly abstract and most students could not see relevance in what was being taught and how it related to their

real lives. In 1988, a report entitled The Forgotten Half (W.T. Grant Foundation, 1988) appeared. That report, and studies conducted in the early 1990s, revealed that the majority of high school students were not being served well by the schools in terms of continuing their education or being prepared for life and work. This led to a call for overall education reform of the high school. The reform called for not only changing the emphasis on what was being taught in schools but how it was taught. More than 50% of high school students were enrolling in the general track which provided them with neither an academic background to go on to further education or a vocational focus which prepared them for work. The new call for reform acknowledged that all students would not be going to college and that the real challenge was to prepare all students for life and work, not only the college bound. This led to a movement to eliminate the general track.

At first the call to eliminate the general track was founded on the belief that all students should take part in the existing college prep or vocational tracks. With further scrutiny, it was determined that academic and vocational education programs developed around old societal needs would not adequately meet the needs of high school students. Old paradigms for academic education were challenged because they seemed to concentrate on abstract learning without explicit relevance to life and work. People began to question whether academic education was being provided for its own sake or as a basis for preparing students for life and work. If it was really a basis for preparing students for life and work, there was a growing belief that teachers should be expected to show where what they were teaching could actually be applied to real situations. Therefore, a major cry emerged for applied instruction that would show students relevance and, therefore, increase student motivation to learn and ability to apply what they learn in the future.

High school vocational education was also challenged because it seemed to be focusing on industrial age employment and occupations rather than the new needs of society. It was seen as only relevant for students who wished to enter skilled and technical jobs in society and not the professions. This led to a challenge as to why it did not adequately address the increasingly broad range of potential occupations in society. If vocational education was to assist students with preparation for life and work, then it needed to increase the breadth of the occupations which it addressed and to expand its role to include the broader range of skills needed in the world of work beyond those procedural skills associated with the past industrial age. Vocational education was also challenged because it often required academic preparation below what many felt was necessary for people to adapt to rapid changes in society. For example, carpentry students often took carpentry math and business education students took business math rather than taking rigorous math courses that would provide them with a broader base of skills. This was viewed by many as "shortchanging" students who took part in the vocational programs.

In response to societal changes and pressures, a major reform of the comprehensive high school is taking place. Educators are being required to examine how basic academics are taught and how preparation for work and careers is accomplished in high schools. This reform is focused on providing all students with a sound functional academic foundation, and options to prepare for the wide variety of life roles and careers associated with modern society. In order to address the heterogeneity of students attending the high schools there is a growing belief that the curriculum should be adapted to clearly show students how what they are learning relates to their future life goals and that this will provide increased motivation to learn. As this movement has progressed there has been an increasing concern about "tracking" students. When the high school curriculum was thought of as having a college prep track, a general track, and a vocational track, students chose tracks but often found it very difficult to change tracks. That is because the nature of the courses students would take in each track were very different and students often did not have a sufficient background to change to

another track once they started a track. It is important to clearly distinguish between the goals of the new movements to revitalize high school education and the old concept of "tracking." The new vision is that if all students are required to obtain a rigorous academic education in addition to an applied education related to a life or work interest, students will and should be provided with the opportunity to change their minds about their future life goals, and therefore, their instructional programs as they move through high school just as college students are allowed to change majors as they proceed through college.

These changes in expectation have led to a major movement to teach academic basics in a more functional manner around real-life applications, and to ensure that career preparation programs are focused on the broad range of skills required in the workplace. Changes in how academic subjects should be taught have been supported by major academic subject matter groups such as the National Council of Teachers of Mathematics (Kurtz et.al., 1990), and the National Center for Improving Science Education (National Center for Improving Science Education, 1989). Both call for increased applied teaching which requires teachers to relate what they are teaching to real-life applications in life and work.

Increased calls for the revision of vocational programs are reflected in the passage of the Perkins Act providing funds for Tech Prep (Brustein, 1993), and the School-To-Work Opportunities Act (Brustein, 1994). The Tech Prep movement has called for the teaching of rigorous applied academics along with the provision of authentic career experiences around broad clusters of occupations relevant to a wide range of students. If all students in high school are to relate what they are learning to a career of life interest, the types of careers students must be able to explore and relate to during high school must include professional as well as skilled and technical occupations. This has required academic and vocational educators to work together to create an integrated curriculum focused on career clusters rather than specific occupations. This movement has also called for articulation between secondary and post-secondary institutions so students can make seamless transitions between high school and post-high school education, or into the work of work. The School-to-Work (STW) movement has called for schools to embrace the notion that all education does not take place within the walls of the high schools, but many worthwhile educational experiences can be accomplished through experiences in the world of work or through service to the community. STW also reinforces the notion that learning should be focused on preparing student for life and work through applied learning. In order to implement STW, schools are encouraged to establish partnerships with business and industry and community service agencies to provide students with opportunities to spend part of their high school programs in real-world situations along side people who are performing real roles in society. Teachers are encouraged to consult with people outside of the schools to identify real-life applications of what they teach. As concepts underlying school-to-work have been proposed as a basis for providing meaningful applied learning experiences for students, critics again have indicated concerns about the new educational reforms. The basic reform underlying school-to-work is to provide opportunities for student to have educational experiences in the real world beyond the walls of the schools. Some critics have associated this effort with a belief that the schools are going to somehow channel students into work slots that match the needs of business and industry to the detriment of individual student choice or desires. As with any educational reform, one can attribute many different motivations and selected groups and individuals will try to position the reform to achieve certain additional goals. However, throughout this paper the concepts regarding STW, applied learning, and revitalizing academic and vocational education are presented as vehicles for providing more meaningful opportunities for students and enabling them to have maximum flexibility in achieving their evolving personal goals and personal self-fulfillment.

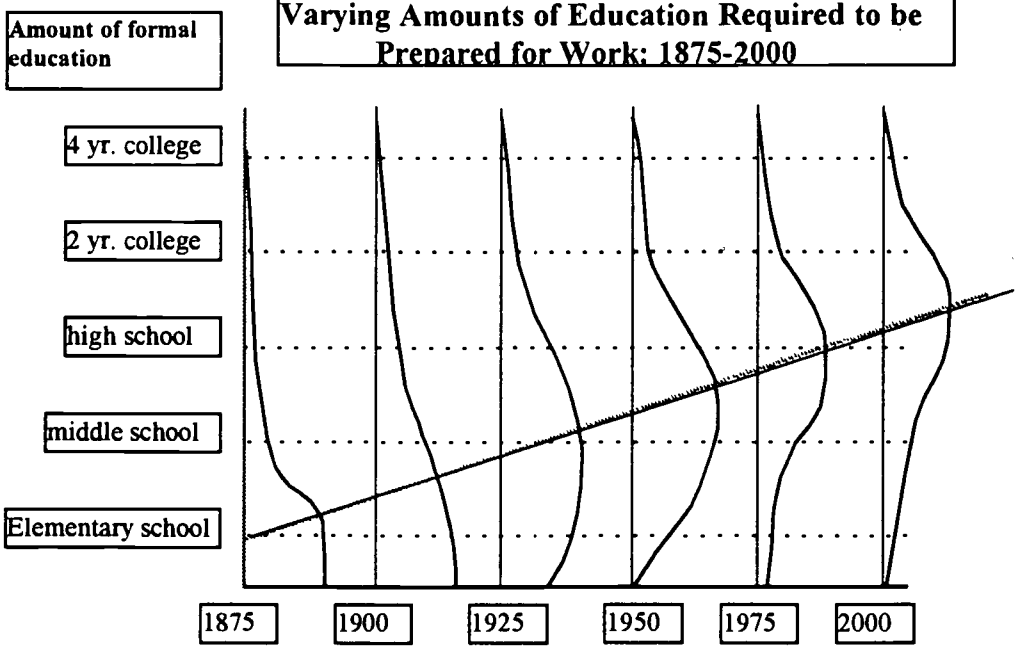
Need to Change High School Vocational Education Programs

In response to societal needs, the expectations for education, and therefore, vocational education curriculum have changed dramatically during the past decade. These changes have probably been more dramatic than at any time since the beginning of the 20th century. The changes are the result of changing views of educators, policy makers, and the public regarding the educational preparation required to be adequately prepared for life and work in modern society. The implications of society moving from the industrial age which spawned Smith-Hughes Act in the United States which led to formal vocational education in the high schools, to the knowledge/imagination age are now being felt in new demands on schools.

Given the changing expectations, vocational education at all levels has been searching for re-alignment with the needs of society. The old Smith-Hughes view of vocational education has been severely criticized as not meeting the needs of modern society. The major elements of the criticism are that vocational education at the high school level can no longer be expected to adequately prepare students for direct entry as skilled workers into the world of work in a highly technological society. The amount of basic academic education and the amount of technical skills and knowledges required to survive in the future workplace can not be adequately developed in high schools. If high schools were to try to prepare students with the necessary work skills to be able to directly enter the modern workplace, they would have to increase the occupational skills focus to the point where students would not be able to develop the broad base of other skills considered to be required to survive in society. This is viewed as unacceptable in light of the already increasing criticism that students who have traditionally participated in high school vocational programs have not been receiving the rigorous academic education required for them to be adequately prepared for workplace and societal changes in the future.

Figure 1 (Pucel, 1996) graphically presents the increasing amount of education historically required as a basis for obtaining specialized preparation for careers. Although the

Figure 1
Varying Amounts of Education Required to be Prepared for Work: 1875-2000



actual amount of education required by any one individual at each time period varies among individuals as indicated by the distribution for each time period, the average amount of education required for individuals to be adequately prepared for work has been continually increased. This is depicted by the slope of the bold line running through the average amount of preparation needed for work for each time period.

Prior to the 1970s there was sufficient curricular space in high schools so students could get the basic education required by society and to still have room to complete occupationally specific career preparation courses. This is represented by the distance between the bold line running through the average amount of education required prior to occupational specialization and the dotted line depicting the high school level. Since that time the amount of basic education required prior to career specialization and the amount of vocational preparation needed to gain the skills needed to perform in occupations have more than filled the typical high school program. There is more to be taught than there is time to teach. This phenomenon has provided increased pressure on the schools to provide a rigorous functional academic education for all students. It has also put pressure on the high schools to revise their views about the feasibility of providing career preparation programs that have the primary goal of preparing students for direct entry into the skilled occupations in the world of work. Most states are now designing their educational systems so specialized occupational preparation takes place at the post-high level. In order to accommodate those high school students who wish to obtain specialized skill training in high schools, most states have some version of a post-secondary options act that allows high school students to attend post-high school classes in technical colleges or community colleges while they are in high school. The fact that such options are being provided to high school students reinforces the expectation that specific occupational training should be done at the post high school level and not at the high school level.

In addition to preparing students with a quality academic and technical education, students are also being expected to develop general employability skills. In both the United States and Canada major initiatives have been undertaken to identify what are considered to be basic employability skills regardless of the particular occupation a person enters, and to see that they are infused into the curriculum. In the United States those skills have become known as the SCANS skills (Secretary's Commission for Achieving Necessary Skills). They were identified by a commission established by the U.S. Secretary of Labor (SCANS, 1991). The commission was composed of a broad-based group of individuals from business and industry. Those skills are presented in Table 1. They are divided into two parts. The first is a three-part foundation that is considered to be necessary in order to be proficient in the five competencies listed in the second part. An examination of the range of these skills quickly indicates the breath of skills students are expected to develop as they prepare for employment.

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, and integrity and honesty

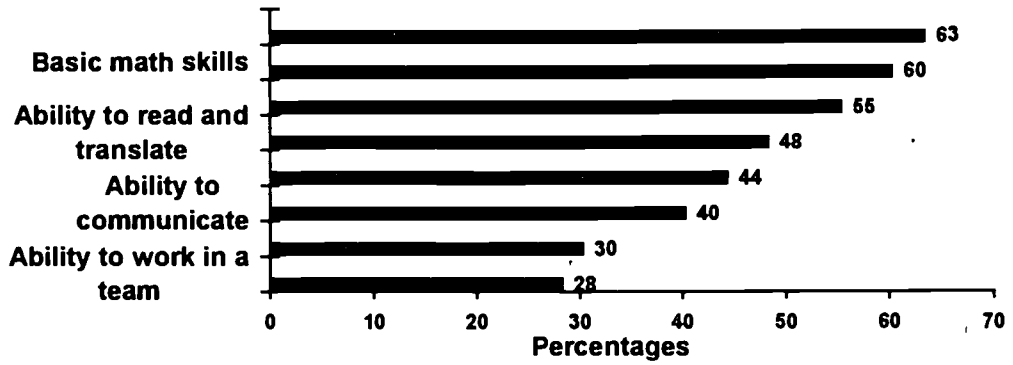
Five Competencies

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

A recent study of the National Association of Manufacturers indicates the extent to which current workers lack most these skills in the United States (See Figure 2). This suggests that these skills are critical even in the manufacturing sector of the economy that has historically been thought of as focusing primarily on workers doing procedural work. Therefore, there has been a realignment of the expectations for what students should achieve in high

Figure 2

Percentage of Surveyed Manufacturers Citing Weaknesses in the Workforce



Source: National Association of Manufacturers, "The Skilled Workforce Shortage: A Growing Challenge to the Future Competitiveness of Manufacturing," November 1997

school vocational education and in the expectations for what should later take place in postsecondary vocational education and in training in business and industry.

Table 2 contrasts some of the old concepts underlying high school vocational education with the new concepts. As the vision of the role of high school vocational education has changed

Table 2
Contrast of Old and New Concepts
Underlying Quality High School Vocational Education

Old	New
High school vocational education contains stand-alone programs which teach limited related academics (e.g., business math, carpentry math) as well as highly specific occupational skills required for occupational preparation.	Vocational programs should be part of a total instructional program to prepare students for careers, and for continued learning in their careers. Therefore, vocational instructor is part of an instructional team. All students should receive a quality academic education in addition to participating in vocational education.

Students should be prepared to enter specific occupations such as carpenter, secretary, or data entry technician.	Vocational education programs should focus on career majors that include sets of vocational courses and academic courses related to clusters of occupations.
Vocational program success is judged based on the number of people who go into the occupation for which trained directly after high school.	Vocational program success is judged based on the number of students who find the programs helpful in preparing for occupations in a career major during and after high school.
Vocational programs are only for students planning to directly enter the world of work.	Quality vocational education should be the center core of the program of studies for many students. It provides a focal point for learning that makes schooling relevant to their lives.
Vocational courses should focus on the technical tasks associated with occupations.	In addition to learning sample technical tasks, all students should be expected to master generalizable work skills and to have exploratory experiences outside of the schools related to their future goals.

from preparing students for direct entry into the world of work in specific occupations to providing students with experiences related to a career cluster, the need for occupationally specific education has increasingly been assumed by technical and community colleges. However, even at the postsecondary level, vocational education has been changing. The need for a broad base of academic skills as well as technical skills to function in the world of work has led most technical and community colleges to require general studies components as part of their programs. Many have developed associate degree programs that have a liberal education component transferable to four-year colleges.

Vocational Education Curriculum Practices

As indicated earlier, until recent times vocational education philosophy and practice continued to evolve to fulfill the societal requirements of the industrial age. Basic vocational education curriculum practices evolved from those fundamentally established in the early 1900s. They focused primarily on preparing students to be able to perform the procedural skills required in business and industry. Basic accepted premises about the way vocational education curriculum should be developed were: a) observe the procedures workers are currently performing on the job, b) develop laboratory settings which as closely as possible emulate the business and industry work environment, and c) teach students to perform the procedural aspects with enough related academic instruction to allow them to apply those procedures. Since the learning of the procedural aspects of occupations required a substantial amount of time, vocational students typically did not get the same types of academic education as other students. They only obtained portions of an academic education consistent with their vocational preparation. For example, carpentry students received carpentry math, and business education students received business math and business communications.

Actual curriculum practices for the delivery of the instruction were consistent with these beliefs. They were focused on ensuring that vocational students were able to perform the procedures required on the job. For example, when asked to do so a student prepared as a machinist was expected to be able to complete a full range of machinist tasks, and a secretarial student was expected to be able to perform a full range of secretarial tasks. In the United State, one of the first writers to write about how vocational instruction should be delivered was Charles Allen. In 1919 he wrote the book The Instructor: the Man and The Job (Allen, 1919). The basic premises which he proposed were based on psychological principles developed in Germany by Johann Friedrich Herbart between 1833 and 1836. Those principles were later translated into English in 1898 in the book The Application of Psychology to the Science of Education (Herbart, 1898). The fact that Herbart's principles were foundational in the way people thought about how to deliver vocational education was re-affirmed in one of the most widely used vocational education philosophy books in the United States during the 1960s, Vocational Education in a Democracy (Process & Quigley, 1957). They stated, "Where instruction is called for, the vocational school has very generally used the standard Herbartian lesson."... The format for such lessons was what Charles Allen defined. In this definition he referred to operations. Operations were the procedural sub-skills associated with doing a job. He suggested that

> "each complete teaching lesson calls for four steps, or teaching operations known as step 1, *preparation*, step 2, *presentation,* step 3, *application* and step 4, *testing* (or inspection). These steps are always carried out in the order given -- The purpose of step 1 is to get the learner ready to be instructed, of step 2 to instruct him (her), of step 3 to check up errors, and of step 4 to give a final inspection of the instruction job." (Allen, 1919, p. 129)

Since these basic tenants for the delivery of vocational education were developed in the early 1900s, some of the terminology surrounding the teaching of vocational education in the schools has changed, but the basic premises underlying the ultimate objectives of vocational education continued to be the same. For example, originally the sub-skills associated with a job were called operations and later became known as tasks. Originally the emphasis was on tutorial instruction as the methodology to teach procedural skills similar to the way skilled workers were taught on the job, later group instruction was adopted for efficiency. Still later it evolved to individualized instruction. Concepts such as stating instructional objectives, defining competencies, competency-based instruction, performance testing all continued to evolve. However, they continued to evolve to accomplish the same goals in much the same way sails were perfected to improve the sailing ships in the earlier example. Almost all of the changes were undertaken to do what had been doing in the past better.

But just as sailing ships became obsolete with the coming of the steam ship, many of the basic goals of high school vocational education and methods of implementing it have become obsolete with the changes in society or have been moved to postsecondary education. In the midst of re-thinking the future role of high school education, both academic and vocational education are facing challenges to develop a different kind of ship. The ultimate goal is still to assist students as they prepare for life and work, but education must prepare them for a different kind of life and work than the past. During the adaptation of vocational education for current and future needs, many of past practices will still be the basis for new practices. The change process required is evolution and not revolution. Evolution suggests a need to modify and adapt current practice to new needs. Revolution suggests throwing what

was done in the past out and totally replacing it with something new. It is important to recognize that much of what has been done in comprehensive high school vocational education and academic education is still sound, it just needs to evolve to achieve new expectations.

Evolving Curriculum Concepts Which Support the Changes in Vocational Education

In order to modify vocational education to meet the new expectations, major concepts that impact curriculum design have been evolving. They are career majors, career activities, applied instruction, project-based instruction, integration, and articulation. Although these concepts have existed in the past in some form, they are becoming more clearly defined and the implications for curriculum design are becoming clearer.

A career major is a series of rigorous vocational and academic courses that reinforce one another and provide a student with academic and vocational competencies focused on a career goal. A career major is analogous to a major in college. It contains academic courses similar to liberal education requirements in college, and vocational or career courses which are similar to college courses in a professional major. Just as college students are allowed to change their majors, high school students should be allowed to change their majors based on their evolving interests. However, during the time a student is interested in a particular career major it focuses and motivates learning and helps a student to develop technological literacy relative to careers which the major addresses.

Career majors can be thought of very broadly. They need not be thought of only in terms of traditional vocational education types of occupations. For example, a school might consider majors in arts and literature, science and technology, engineering, business and management, family and consumer science, agriculture and the environment, construction, manufacturing, or legal and government occupations. Majors can be developed around any cluster of occupations.

Career activities are major units of work a supervisor would ask a person to complete on the job (job assignments). They become the foci for instruction within a career major. They are not to be confused with tasks that are sub-components of career activities. Often vocational courses have been organized around a task listing of the procedural skills students are to master. Those skills are taught one at a time and student progress is checked-off. This type of instruction has led to a focus on the sub-skills without a focus on how those sub-skills relate to authentic real work. Career activities are actual types of projects or assignments a person who is working within occupations contained within a career major would be asked to perform on the job. They require the authentic application of various combinations of the sub-skills or tasks. Focusing on career activities rather than tasks provides students with a more holistic view of the career(s) in which they are interested. For example, a career activity in a manufacturing major might be to build a solar heating device, or in a construction major to build a wall. The activity to build a wall might require the following specific sample technical competencies: a) psychomotor; cut studs, create a window opening, b) cognitive; calculate the number of studs, decide where to place windows, and c) affective; cooperate with co-workers, accommodate the owner. The activity might also be used to show the application of math or writing skills. The activity might also be used to teach teamwork and research procedures. In other words, the career activity becomes the anchor point for teaching many different competencies in an integrative manner rather than teaching each as a separate entity.

Applied instruction is instruction that shows how what is being taught is applied in the real world. Often sample applications of what is being taught are presented by the instructor during the teaching process. In addition, students are asked to search out applications of the content in the context of their career majors in order to reflect on how what is being taught is

related to what they would like to do in the future. Although applied instruction has long been a characteristic of vocational courses, it must also become a characteristic of academic courses.

Project-based instruction is a methodology for implementing applied learning around authentic real-world career activities. Although vocational educators have had a long history of teaching around projects, the new view does not treat the production of the end product of the project as the major focal point of instruction. The project is viewed a vehicle for teaching a wide range of skills and knowledge. In other words, the major goal of the project is to focus learning and as well as to produce a product. For example, a project might be the development of the solar heating device in a manufacturing major or the construction of a wall. Projects should not only be designed to produce something physical, but to accomplish other goals. For example, projects can be based on designing, making, assembling, testing, evaluating, or planning.

Integration is the process of different subject matter fields cooperating with one another to develop a unified instructional program. Often the instruction is developed around authentic career activity projects. For example, language arts, science, math, social studies, and manufacturing career major instructors could develop an instructional program around the need for hot water for hygiene purposes in an African country. The solution might be a device for solar heating of water. The science instructor could teach concepts such as heat absorption, focusing light, and the effect of color on heat absorption around the project. The math instructor could teach mathematical concepts around calculating the shape of a reflector that will focus light and how much heat will need to be captured to efficiently heat the water. The manufacturing instructor could teach the metalworking, materials finishing, and assembly required to make the device. The social studies instructor could teach about the cultural hygiene values of the people and their implications for the economy. The language arts instructor could teach research techniques and writing around gathering necessary information to complete the project. The instructors could meet and inform each other about what they were going to teach and each instructor could refer to and reinforce what the other instructors are teaching.

Although this example indicates how instruction can be integrated using multiple subject matter areas, integration can occur through any two or more subject matter areas cooperating. It can also occur by instructors in the various subject matter areas just informing each other about what they are teaching so if an unplanned opportunity arises they can reinforce what the others are teaching. For example, if the manufacturing instructor knew what math was being taught, the instructor could highlight how what the math teacher is teaching is actually applied in the manufacturing.

Articulation is the process of developing instructional programs cooperatively between different educational levels. For example, between high school programs and postsecondary programs. The programs are developed to allow students to progress through a series of activities that are non-duplicative and additive as they move from one level to the other in pursuit of their goals. Such a curriculum is often referred to as a "seamless" curriculum. For example, a high school might have a manufacturing career major. That program would provide students with experiences related to a cluster of manufacturing occupations such as machinist, production control assistant, welder, and automated systems technician. In designing the courses for this program, the high school staff could meet with the postsecondary staff of the local community/technical college which provides occupationally specific education in these occupations to determine how they might articulate their programs so students completing the high school program might enter the postsecondary programs and receive credit for what they did in high school. This would allow students to make a seamless transition from high school to post-high school with a non-duplicative curriculum. This means that the courses taught in high

school would not be the same as those taught at post-high school, but that the courses would be additive.

As these new concepts are implemented it is important to ensure that the career major vocational courses are well planned and executed. Content which exemplifies the range of technologies and real activities of careers addressed by a career major must be identified and systematically presented. Students must complete activities that would actually be done by those working in the career area using real tools, equipment and materials. Vocational courses can not be viewed as primarily as a means of demonstrating the application of academic subjects. They also can not be organized around community projects unless those projects can be used as vehicles to teach content which has already been identified as important. The projects available should not dictate the content to be taught but projects should be selected to teach important content. Vocational courses associated with a career major require the same logical and conceptual planning as math or science courses in order for them to be effective.

New Initiatives

As these new concepts about organizing the high school curriculum around career majors have been accepted, legislative as well as state and local initiatives have promoted their implementation throughout the United States. Federally funded Tech Prep programs have been developed in each of the states and territories. Tech Prep calls for the implementation of each of the concepts presented above. It promotes integration, articulation, and applied instruction around clusters of occupations. (Brustein, 1993) Tech Prep programs require the development of consortia between postsecondary institutions and surrounding high schools. Articulated programs are developed between the secondary and postsecondary programs that require the integration of academic and vocational subjects.

Another major initiative is that of the Southern Regional Education Board's (SREB) efforts to revise secondary vocational education in 13 southeastern states. It has also promoted the development of integrated and applied learning programs. Over 500 schools have been participating in the SREB's efforts (Bottoms, Pucel & Phillips, 1997). What is clear is that vocational education curriculum at the secondary and postsecondary levels will never go back to only technical skills preparation and that curriculum practices to incorporate the new goals are required.

Changes in Vocational Education Curriculum Practices

Course goals for secondary vocational education have been expanded to include many dimensions that have not been formally addressed in the past. In the past, those developing vocational courses would have been expected to teach students the technical skills and knowledges required to perform in an occupation. They were often determined through an occupational (task) analysis to identify what people actually do on the job. Since most work prepared for through vocational education during the industrial age tended involve psychomotor skill, what a person does with their hands, that had become the primary focus of instructional methodology. Today the technical skills required to perform in any of the occupations in a career major occupational cluster include not only psychomotor skills, but cognitive decision making and information processing skills, and affective skills which address how people relate to people, data, and things. However, the teaching of occupational technical skills and knowledges is only one dimension of what is being expected of high school vocational courses. During the completion of a course other typical goals are that students will:

- Experience authentic career activities representative of a career major(s).
- Master academic and SCANS employability competencies associated with career activities.
- Complete their work to workplace quality standards.
- Adopt safe practices and safety consciousness.
- Solve workplace problems during the completion of typical career activities.
- Research careers of personal interest.
- Have work-based learning experiences in the community outside of the school classrooms.
- Have access to articulated education experiences.

Course content is obtained from a variety of sources to accomplish this wide range of goals. Although the sources of course content and types of content presented below are equally applicable to secondary and postsecondary vocational education, the way in which that content is addressed at each of these levels has changed. In the past both secondary and postsecondary vocational programs were expected to prepare students for direct employment in occupations requiring less than a baccalaureate degree. Therefore, they both focused on specific occupational skills needed for direct employment. If secondary vocational education is to concentrate on broad career majors and postsecondary vocational education is to focus on specific occupational preparation, then the occupational breadth of these two types of programs should be different. When developing a secondary vocational program around an occupational cluster, one would want to find occupational content applicable to many different occupations within that cluster. For example, if a business major was being developed it might focus on occupations such as data processing, accounting, word processing, and entrepreneur. At the postsecondary level programs might be developed to prepare students for each of those specific occupations. In other words, although the types of skills to be addressed in secondary and postsecondary programs might be the similar, the occupational specificity of the skills to be taught and the ultimate goal of instruction would be different.

Typical occupational analyses still need to be conducted to determine the technical psychomotor, cognitive, and affective skills to be addressed by a course. However, other skills must also be addressed. In order to ensure this broader view of required skills is implemented, National Skills Standards are being established in the United States to provide benchmarks for the types of skills needed in various occupations. The National Skill Standards Board (NSSB) was created by Goals 2000 Educate America Act of 1994. The Standards are being established by groups representing each occupation to provide guidelines for certifying that individuals meet industry skill standards for that occupation. Samples of such skill standards are available at the web site *http://www.nssb.org*. The skill standards address relevant technical skills, SCANS employability skills, and relevant academic skills. Soon O*NET (Occupational Information Network) will be available as a replacement for the old Dictionary of Occupational Titles. The new structure of O*NET is currently available on the web site *http://www.doleta.gov/programs/onet/*. It again addresses the full range of skills associated with an occupation. All of these national efforts at identifying skills people will need to succeed in the workplace are gradually replacing the notion that local job analyses should determine the content to be taught in high school vocational programs. Students graduating from high schools can be expected to go into a range of occupations in many geographical regions. Just as academic subject matter areas have had national standards which are used to judge the content requirements of academic courses, the goal in the United States is to have vocational programs aimed at generalizable career preparation standards.

However, it is again important to remember that high school vocational courses should address a career major cluster of occupations and not specific occupations. Therefore, in order to determine the types of career activities that students might experience within a career major

it would be necessary for instructors to look for generalizable skill requirements across the specific occupations contained in the major's occupational cluster.

How and who should deliver instruction within a career major is changing as well the content of majors. The belief that the vocational instructors should provide all of the technical and related academic instruction within a major is no longer viewed as appropriate. In the past, students were often taught "related academics" by the vocational instructors. The related academics included those specific academic skills that were needed in the occupation for which students were being prepared. For example, business major students would be taught math skills required in business occupations by vocational instructors in a course called business math. Similarly carpentry students would be taught carpentry math by their carpentry instructor. Emphasis is now being placed on all students having a rigorous academic education provided by academic instructors though integrated instruction where the vocational instructor and the academic instructors work as a team.

Also, in the past vocational education was delivered primarily within the classrooms and laboratories of schools. It is now recommended that students be required to complete part of their education through community-based activities. Assignments should be given which require students to interact with people in occupations in their career major outside the classroom.

Methodologies for the delivery of instruction must also change. In the past instruction was delivered by the instructor through mainly lecture and demonstration and students were expected to apply what they learned by doing what was demonstrated and answering questions. Since workers on the job would typically have been given very specific directions to complete their procedural work, the same approach was used in the classroom. Assignments were presented with most of the information needed to complete a project provided. That type of instruction often led to "monkey-see, monkey-do" instructional techniques. Students did what instructors showed them and repeated back information instructors taught them. Although this instructional technique worked well when it was expected that students would be treated the same way when they entered the workplace (employers would show employees what to do and they were to do it, and if they needed to do something different employers would again show them what to do), this instructional technique does not fit with the new employment expectations of the knowledge/imagination age. Employees in the modern workplace are expected to solve problems, think for themselves, adapt to new situations, upgrade their own skills when needed, work in teams, be responsible for their own activities, etc. In order for students to be prepared to do these things instructional practices must change.

Instruction must be delivered in ways that will require students to problem solve, work in teams, search out information, explain what they are doing and why, and apply academic skills within their career area. Instructors must change their role from one of presenting all of the information students need and solving all of the problems, to one of presenting students with situations which require them to search out information and to arrive at their own problem solutions, as individuals or in teams.

Vocational course achievement should be evaluated through expanded methods. Assessment of students in vocational courses in the past concentrated almost exclusively on the extent to which students mastered specific occupational skills and knowledges. Although these are still important, they currently are not the only foci of student evaluation. Given the new broader goals such as teaching students how to problem solve, to develop generalizable employability skills, and to learn how to learn; all vocational courses must also include instruction and evaluation focused on these skills as well. They must also include assessments of the extent to which students have accomplished educational goals through work and community-based activities.

At the career major program evaluation level it is important to recognize that the criteria for judging the success of a vocational program have changed. There is much less emphasis on how many people go directly into a related occupation or additional occupationally related education directly after completing their high school program. Although this is still a reasonable goal at the postsecondary level, it is no longer the sole goal of secondary programs. Other criteria must be applied such as how many students were helped to make an occupational choice, how many students found academic instruction related to their vocational major more satisfying than the typical abstract academic instruction, how many students remained in schools because they found their education functionally related to their futures, how many students established contacts as part of their career major programs which facilitated their transition from school to the real world, and how familiar are students with the technology, methods, and ideas of their career areas.

Developing the New Curriculum

The development of the new career major curriculum in the comprehensive high school requires much more planning than the old curriculum (Pucel, 1995b; Pucel, 1996). It must involve all personnel within the school as well as people from the community and parents. Administrators, counselors, and academic personnel must view career majors as making a significant improvement to the quality of education for all students and not as an alternative to the traditional college preparatory program. Parents must understand the goals of the new curriculum and how it benefits their children, and community representatives must provide input into the career majors that are appropriate for the community and what to include within them.

Determining a school's career majors and sample careers within each major is the first step in the development of the new curriculum. This is a complex issue because it not only involves taking the local interests of the students and the community into consideration, but the national employment markets and the extent to which the curriculum in the school can actually deliver a set of courses related to the career area. In large comprehensive high schools or technical centers it may be possible to develop career majors around rather narrow foci such as construction. A construction major would require the school to be able to offer highly specific courses related to construction such as masonry, carpentry, architectural drafting, electrical power and wiring, site preparation, and construction financing. In smaller comprehensive high schools the curriculum may not be able to support such highly focused courses. In such cases the career majors may need to be defined more broadly. For example, rather than a construction major the school may define a technical major which it can actually support through its curriculum. Such a major might include less specific courses such as wood technology, basic drafting, metal technology, power mechanics, architectural drafting, auto mechanics, building construction, and welding. The following is a list of sample majors schools have developed in various vocational areas.

- Agriculture Majors
  - Entrepreneurship (Production)
  - Natural Resources (Environmental)
  - Agri-business (Sales) (Services)
  - Agri-mechanics
- Business Education Majors
  - Business Technology
  - Business Operations
  - Office Technology
- Family and Consumer Sciences Majors
  - Health and Human Services

Personal Living Skills
Child Care
Consumer & Social Sciences

Technology Education Majors
Engineering, Science, Technology
Manufacturing
Construction
Transportation
Electrical
Communications
Bio-Technology
Environment

Once the majors have been identified it is important to list sample careers that would be addressed within each major. This makes each major more conceptually concrete as the instructional program is developed and explained to others. It also presents a list of career alternatives which students might consider. Appendix A presents some sample majors and careers which they address.

Identifying which courses are to be included within a major is the next step. The total set of major courses a student takes throughout high school should be additive and each must contribute to a student's overall experience. Courses should be selected based on the extent to which they will provide students with content and experiences relevant to their career major.

The courses should be separated into core courses and electives. The core courses should include those that all students in the major must complete. Core courses can include both academic and vocational courses. Elective courses should also include vocational and academic courses. Career majors should include space for electives just as college majors do. This provides opportunities for students to pursue their unique interests within a major. For example, a person interested in industrial engineering who is in a manufacturing major might elect to take calculus while a person interested in becoming a welder might want to take a welding course at the local community college. Appendix A presents a sample of courses which might be included at each grade level for three different majors.

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Appendix A
Sample Career Majors

ENGINEERING, SCIENCE TECHNOLOGY MAJOR SAMPLE
Leading to Engineering, Manufacturing, Industrial Technology, & Skill Trade Careers

GRADE 9

English 9
Civics
Physical Science
Algebra 9 or Math 9
Industrial Technology
Art (S)
Gym (Q)
Swim (Q)
Health

ELECTIVES
Foreign Language*

GRADE 10

English 10
World Studies
Math Track 1,2, or 3
Principles of Biology
Health (S)
Physical Education (S)
Communication Skills (S)
Drafting
Principles of Technology 1

ELECTIVES

Foreign Language*
Auto Technology 1
Small Engines 1
Wood Technology 1
Word Processing (S)
Welding 1

GRADE 11

English 11
United States History or
Honors US History

ELECTIVES
Foreign Language*
Math Per Track
Advanced Biology
Auto Technology 1 or 2
Chemistry

Computer Programming
Drafting
Environmental Science (S)
Physics
Psychology (S)
Principles of Technology 1 or 2
Small Engines 1 or 2
Welding 1 or 2
Wood Technology 1 or 2

GRADE 12

English 12 or
Honors English
Senior Social Studies

ELECTIVES
Foreign Language*
Math Per Track
Advanced Biology
Auto Technology 1 or 2
Chemistry

Computer Programming
Drafting
Environmental Science (S)
Physics
Psychology (S)
Principles of Technology 1 or 2
Small Engines 1 or 2
Welding 1 or 2
Wood Technology 1 or 2

Career Examples

1 or 2 Years College	4 Years College & +
Appliance Repair	Agriculture
Architectural &	Architecture
Construction Tech.	Aviation
Automotive Service	Biologist
Tech.	Chemist
Carpentry	Computer Science
Drafting	Electrical Inspector
Diesel Mechanic/	Educator-sciences &
Heavy Equipment	technologies
Maintenance	Engineer -
Electrician	automotive, agriculture,
Farm Management	aerospace, biomedical,
Forestry Technician	chemical, civil, electrical,
Golf Course Grounds Mgt.	environmental, industrial, mechanical, mining,
Heating, Ventilation,	mineral, computer,
A/C Tech. and Repair	manufacturing, petroleum,
Horticulture Tech.	refrigeration
Industrial Instrumentation	Energy Systems Design
Industrial Maintenance &	Environmentalist
Mechanics	Forestry
Machining Technology	Geologist
Manufacturing Technology Specialist	Geographer
Millwright	Manufacturing
Nursery/Landscape	Meteorologist
Pipe Fitter	Mineralogist
Plumber	Naturalist
Small Engine Repair	Production Planner
Tool & Die Maker	Researcher - various
Truck Driver	Scientist - various
Waste Treatment Technician	Statistician
Welding	Surveyor
Woodworking	

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BUSINESS & MARKETING MAJOR SAMPLE

Leading to Business, Clerical, Managerial Office, & Sales Careers

GRADE 9

English 9
Civics
Physical Science
Algebra 9 or Math 9
Gym (Q)
Swim (Q)
General Business (S)
Art (S)
Health
ELECTIVES
Foreign Language*

GRADE 10

English 10
World Studies
Math Track 1,2, or 3
Principles of Biology
Word Processing (S)
Marketing & Management (S
Health (S)
Physical Education (S)
Communication Skills (S)

ELECTIVES
Foreign Language*
Occupational experience
Accounting
Desktop Publishing (S)

GRADE 11

English 11
United States History or
Honors US History
Business & Software Exploration (S
Personal Finance Management (S)

ELECTIVES
Foreign Language*

Math Per Track
Accounting
Occupational experience
Desktop Publishing (S)
Personal Law (S)

GRADE 12

English 12 or
Honors English
Senior Social Studies
Computer Programming

ELECTIVES
Foreign Language*

Math Per Track
Occupational experience
Psychology (S)
Personal Laws (S)
Desktop Publishing (S

Career Examples

1 or 2 Years College	4 Years College & +
Administrative Assistant	Abstracter
Accounting Clerk	Accountant
Bank Clerk	Advertising
Bank Teller	Attorney
Bookkeeper	Banking and Finance
Call Center Specialist	Business Administration
Clerk Typist/Office Assistant	Buyer
Clerical Data Entry	Computer Sciences
Computer Operator	Economics
Court Clerk	Fashion Marketing
Credit and Finance	Financial Analyst
Golf Course Facility Mgt.	Government
Paralegal	Administration
Secretary - various types	Marketing and
Travel Guide/Services	Management
Ticket Agent	Purchasing Agent
	Program Planner
	Real Estate
	Retail Marketing
	Small Business Mgt.
	Training Director
	Title Examiner
	Underwriter
	Urban Planner

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FINE ARTS MAJOR SAMPLE

Leading to Artistic, Educational, Musical, & Literary Careers

GRADE 9

English 9
Civics
Physical Science
Algebra 9 or Math 9

Art (S)
Gym (Q)
Swim (Q)
Health

ELECTIVES
Foreign Language*
Band
Choir
Orchestra

GRADE 10

English 10
World Studies
Math Track 1,2, or 3
Principles of Biology
Health (S)
Physical Education (S)
Communication Skills (S)

ELECTIVES
Foreign Language*
Art 1
Band
Choir
Desktop Publishing (S)
Ind. Living and Interior Design (S)

Orchestra
Photo 1
Word Processing (S)

GRADE 11

English 11
United States History or
Honors US History

ELECTIVES
Foreign Language*
Math Per Track
Art 1 or 2
Band
Choir
Desktop Publishing (S)
Ind. Living and Interior Design (S)
Orchestra
Photo 1 or 2 (S)
Word Processing (S)

GRADE 12

English 12 or
Honors English
Senior Social Studies

ELECTIVES
Foreign Language*
Math Per Track
Art 1, 2 or 3
Band
Choir
Desktop Publishing (S)
Ind. Living/ Interior Design (S)
Photo 1 or 2 (S)
Psychology (S)
Orchestra

Word Processing (S)

Career Examples

1 or 2 Years College	4 Years College & +
Clothing and Textiles	Actor
Commercial Artist	Art
Graphic Artist	Broadcasting
Floral Design	Choreographer
Film Technician	Communications
House and Interior Design	Commercial Design
Illustrator	Fashion Design
Interior Decorating	Film Director
Make-up Artist	Foreign Language Interpreter
Mass Media Technician	Industrial Design
Merchandise Display	Journalism
Musical Instrument Repair	Librarian
Performing Artist	Media/ Telecommunications
Photographer	Music
Program Coordinator	Set Illustrator
Stage Technician	Teacher/Coach - art, drama, English, media, music, speech

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