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Development of a curriculum model for vocational/technology education

Schnellert, Gary Loyd, Ph.D.

Iowa State University, 1993

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Development of a curriculum model for vocational/technology education

by

Gary Loyd Schnellert

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CHAPTER I. INTRODUCTION

"When one compares the revolutions that have occurred in this century in technology, transport, medicine, warfare, politics, the status of women and patterns of employment, schools appear strangely static" (White, 1992, p. 153).

What educators try to do has changed little over the years although social forces and philosophic speculation have been more responsible than educational research for those changes that have occurred (White, 1992). According to Harkins (1992) there has been little evolvement in school curriculum in comparison to the vast changes in society and at times, the way things have always been done exercises a veto power stronger than any other changing force. The curriculum is already full and there is much resistance to "giving up" accepted content to make way for progress.

There are at least three important educational issues which have begun to emerge in the educational community. First, educational excellence and learning is clearly not an activity or a phenomenon existing on a single continuum or as a single dimension of the educational enterprise. As an example, it is not only a curriculum content or methodology problem, an approach favored by many who simply decide what subjects should be required of everyone and therefore, be a requirement as the chosen intellectual food for everyone.

Second, the problem of repairing education or healing its ills may not be possible within a single system of universal education or appropriate in
comprehensive schools. After all, schools are institutions created to reproduce and enhance societies' norms or, more frankly, to teach the magic of the tribe to the young. Yet the norms which are most administratively advantageous in schools are often those which are most instructionally disabling to students. Academic tracking, the uniformity of class sizes, the propensity to test what is not easily testable, and the lack of connective tissue to link the community's academic structure to its occupational structure are all examples of disjunctures which appear to oppose reconciliation.

Third, a significant share of the problems of education are related to what is happening outside the schools, and it is logical, therefore, to look for some of the remedies outside them. The problems of educational excellence may be symptoms of society in conflict with itself. Meanwhile, educators who are attempting to recover from a permanent condition of crises learn that it was not a recovery, only a transition.

The question then becomes, What are the practitioners to do? Instructively, "...teachers are to use proven methods to build predictable, successful learning," claimed Corrigan (1993, p. 3). How will this be best accomplished? Perhaps this is best brought about through a model. Nadler (1988) stated that, "A good model can help one understand what is essentially a complex process" (p. 5). One such model is the School Improvement Model (SIM).

The School Improvement Model (SIM) research team, centered in the Research Institute for Studies in Education at Iowa State University, has been very
successful in implementing the assessment of outcomes with standards in many school districts. It ensures accountability of students, teachers and administrators (Manatt, 1993a). The success of SIM is—in a large part—due to the planning and direction from a stakeholders’ committee. Manatt (1989) further stated that "The stakeholders are cast in the role of clients who want to build a new ‘house,’ the SIM consultants and technicians are the architects and builders" (p. 5). The philosophy of the SIM model requires key learning points to be teacher-driven with locally made selection. Curriculum alignment in the SIM model uses pre- and post criterion-referenced tests which assures high curriculum density.

Recently, curriculum as such has received a great deal of attention. Curriculum alignment has, in part, been called by several different names, such as curriculum renewal, curriculum mapping and curriculum reform; however, the basic emphases have remained the same—that careful measurement of student achievement leads to accountability of all parties (Manatt, 1990; English, 1992; Fullan, 1993).

Curriculum alignment is the assurance of continuity between the written curriculum, the taught curriculum and the tested curriculum. Confusion arises when people speak about curriculum. When curriculum is referred to, it might concern any of the following (Harkins, 1992):

... curriculum as found in published documents (published curriculum); or curriculum that a teacher actually teaches (taught curriculum); or curriculum as measured by test results (tested curriculum); or curriculum the student actually learns (learned curriculum). (p. 56)

Many present-day defenders of student achievement would argue there is one main reason that the test results appear so dismal. The claim of the defenders is that
the curriculum and teaching methodology have changed whereas the tests have not. The image which is being portrayed is that norm-referenced tests do not reflect what is being taught or intended to be taught. Therefore, the argument continues, student achievement only appears poor because the tests are not aligned to what is actually taught.

This study explores some features and current trends in education especially vocational/technology fields which are related to the tensions which surround the journey leading toward the goal of excellence and particularly those areas that involve curriculum renewal, alignment and assessment.

Statement of the Problem

Very limited work has been done utilizing the School Improvement Model in the vocational/technology area. Many school restructuring models conspicuously do not mention vocational or technology education. An observation made by Pucel (1990) supports this contention. Pucel and Cheek (1990) noted that in a Summary of major reports on education, completed November 1983, five of the 10 reports ignored vocational education and its role in the high school! The following reports are those which failed to mention vocational education:

1. *A nation at risk*;
2. *Action for excellence*;
3. *Report of twentieth century fund task force on federal elementary and secondary educational policy*;
4. *High school: A report on secondary education in America*; and

5. *Academic preparation for college: What students need to know and be able to do.*

The future economic success of North America (Canada and the United States) will depend on the criteria of "education, education, education" as stated by Placek (1991, p. 5). Through education, a competent work force is achieved which is necessary for economic success (SCANS, 1992). This places vocational/technology education in the forefront to ensure the future of North American economic success.

The problem of this study is to investigate several aspects of the School Improvement Model and consider its applicability in addressing the needs of vocational/technological education at the secondary school level.

Purpose of the Study

The purpose of the study was to determine if and how the School Improvement Model (SIM) for curriculum renewal, alignment and evaluation can be successfully applied to the vocational/technology area.

The rationale for curriculum alignment is to raise student achievement (learned curriculum). While the issue of raising student achievement is important, it is also valuable to know if there is equal opportunity for all students and teachers in
the SIM method of curriculum renewal and alignment. Therefore, the present investigation will also ascertain if all teachers and all students have an equal advantage derived from the renewed curriculum. The academic subjects of government and economics will be the test subjects. The data will be taken from a school district in the Florida Keys, Monroe County.

Manatt (1989) expressed, "The heart of the School Improvement Model is the planning and direction from a stakeholders' committee" (p. 4). The stakeholders' committee is comprised of school district representatives including teachers, administrators, board members, parents (and, at times, students). It is through the stakeholders' committee that the subject curriculum committees are established. Wilson and Stow (1990) stated, "Though all schools have a curriculum, most of the time its development is the responsibility of virtually everyone and, as a result, no one" (p. 1).

Objectives of the Study

The following objectives were presented to accomplish the task of determining if and how the School Improvement Model (SIM) can be successfully applied to the vocational/technology area.

---

1. The teachers who had no part in developing the curriculum but received instruction on the renewed and aligned curriculum through professional development.
2. The teachers who developed the new curriculum.
3. The teachers who developed the new curriculum and developed the test items.
1. Review, examine and document the SIM model in each of the four areas with respect to its techniques and approach:

   a. Minneapolis district for a long term analysis;
   b. Thermopolis, Wyoming for testing only;
   c. Monroe county for the entire SIM package; and
   d. Arizona SIM for the multi-district approach.

2. Determine how SIM works in:

   a. identifying what the district is doing;
   b. renewal in the district curriculum;
   c. alignment of the curriculum within the district;
   d. scope and sequence development;
   e. pilot testing the courses; and
   f. orientation of all teachers.

3. Develop a list of curriculum content determination factors in the vocational/technology area based on a review of literature.

4. Analyze how the psychomotor aspects of physical education are evaluated in the SIM and related models and determine if it is appropriate for the vocational/technology area.

5. From the review of literature assess if other curriculum reform concepts could assist in the transformation process.

6. Ascertain if the renewal, alignment, and evaluation processes of SIM are appropriate for the vocational/technology area.
7. Develop a model and identify the criteria for validation using a knowledgeable panel of researchers and practitioners.

Research Questions

The following questions were used to guide the study:

1. What are the differences between the vocational/technology and the academic areas in regards to curriculum renewal and alignment?

2. How can the School Improvement Model (SIM) of curriculum renewal/alignment be applied to the vocational/technology area?

3. Which are the necessary vocational/technology curriculum alignment steps that differ from the current SIM curriculum model?

4. How can perceived differences between the academic and the vocational/technology areas be accommodated in the model?

5. Do other curriculum reform concepts offer potential advantages which might well be applied to the vocational/technology area or adapted into the current SIM model?

6. How do student evaluation procedures and approaches in the vocational/technology areas differ from those currently used in the SIM model for academic subjects, and yet achieve the desired results?

7. Do all students have the advantages of the renewed curriculum regardless of the level of involvement of their teachers in curriculum renewal and test development?
Research Hypothesis

There was one hypothesis in the study:

There will be no significant differences in achievement of students as measured by gain scores whose teachers:

1. had no involvement in the renewal and test development;
2. were involved in curriculum renewal; and
3. were involved in the renewal and test development.

\[ H_0: \mu_1 = \mu_2 = \mu_3 \]
\[ H_a: \mu_1 \neq \mu_2 \neq \mu_3 \]

Basic Assumptions

It was recognized that there were certain conditions or circumstances affecting the study which could not be controlled or manipulated by the research design. The basic assumptions of this study included the following:

1. The results from Monroe county represents only a small sample and may not necessarily be generalizable.
2. All the teachers in the semester course on government and economics had adequate professional development in the renewed curriculum.
3. The knowledgeable panel were candid and honest in responses to questions posed by the investigator.
Delimitations of the Study

There were several delimitations in this investigation. Efforts to ensure that the study was rigorous and made a valuable contribution to the scientific knowledge base on curriculum development, required a careful examination of the following delimitations.

1. The criteria developed for the knowledgeable panel was derived from the literature review, discussions with curriculum personnel, research of effective teaching, current curriculum evaluation procedures and research relative to curriculum development.

2. The data were generated from six teachers and 247 students in grade 12 classes in economics and government in Monroe County, Florida.

3. Persons selected as the knowledgeable panel for this research had experiences in curriculum development. This study did not attempt to determine if the panel had vocational/technology experience, only that they were knowledgeable in curriculum development.

4. The study of SIM included four districts.

5. The information for the SIM districts that were studied was derived from the literature as well as through conversations with R. P. Manatt and S. Stow.

Definition of Terms

Several terms were defined for use in the study.

Authentic assessment - The general term used for observation and demonstration measurement. It is known to contain 3P's: product, portfolio and performance.
Career technical assessment project (C-TAP) - Developed by The Far West Laboratory utilizing performance standards.

CIPP (content, input, process and product) model - Developed by D. Stufflebeam for the improvement of curriculum evaluation.

Competency based education (CBE) - A curriculum concept where criteria is developed and students must demonstrate competence at each step. May also be known as; competency based vocational education (CBVE), competency based learning (CBL), and individual competency based learning (ICBL).

Curriculum - "A course of study, an arrangement of subject matter or a plan of what is to happen in school" (Willis, 1988, p. 316). More simply the "what" that is to be taught.

Curriculum alignment - To have the written curriculum match the taught and tested curriculum.

Curriculum assessment - The evaluation of curriculum information and material.

Curriculum determinators - The sources of information used to determine what content the curriculum will utilize.

Curriculum renewal teachers - Teachers who were employed to renew the curriculum within their discipline and district.

Curriculum renewal - The process of reviewing a curriculum and adding needed additional material while deleting material which is determined to be not as important.

Normative-referenced tests - A standardized test used to find out how each individual
learner performs in relation to the performance of other individuals on the same test.

**Outcome-based education (OBE)** - Developing, delivering and documenting instruction in terms of its intended goals.

**School transformation** - A change so dramatic to a school or schools that it makes a major difference. To change the paradigm entirely.

**School improvement model** - A model developed at Iowa State University, College of Education which encompasses a wide cross section of educational services to school districts.

**SIM** - Abbreviated acronym for Iowa State University, College of Education, School Improvement Model.

**SIM II** - Phase two of the School Improvement Model which focuses on curriculum renewal and alignment, student achievement, teacher accountability and curriculum assessment.

**Teachers who had no part in developing curriculum** - Those teachers who teach a specified subject yet who were not employed to renew the curriculum or develop tests for the curriculum.

**Test development teachers** - A subset of the curriculum renewal teachers who were employed to develop test questions for the desired outcomes.

**Vocational/technology** - A broad area of study known to most in academia as the practical arts. This would include: industrial arts, industrial technology, industrial education, technology education, vocational industrial education, and vocational education.
CHAPTER II. REVIEW OF LITERATURE

This chapter consists of four parts: a) curriculum overview; b) curriculum theory and development; c) curriculum evaluation; and d) educational curriculum and assessment models. Numerous categories of information were reviewed; the published material included broad-based articles in various professional journals as well as writings with a more narrow focus from specific studies, such as dissertations and position papers. The sources of information included, but were not limited to, library indexes, *Educational Administration Abstracts, Dissertation Abstracts International*, and other collections of educational research studies. Further sources were identified from citations in journals and books as well as telephone interviews with P. Allen, M. Knowles, W. Spady, R. Stiggins, B. Tyler, and G. Wiggins. Personal interviews were conducted with several faculty members, especially R. Manatt, S. Stow, and W. Wolansky.

Several limitations of the research strategy should be noted:

a. A systematic study of sources outside the United States was conducted, however, a majority of the desired materials was not obtainable within a five-month time span;

b. Some of the studies were from published sources which tend to report only those with significant findings; and

c. No doubt numerous additional contributions have been made to the existing body of knowledge which may be related and relevant, but due to time and other constraints were not included in the present study.
Curriculum Overview

Many people are ready to criticize the public schools, in particular, for having strayed from a core academic mission. However, they often turn first to the schools as a means of addressing a wide range of social problems, with solutions ranging from driver education—to substance abuse treatment, physical fitness, or AIDS education and family life (McClaren, 1989). McClaren continued by stating, "It is easy to single out one or another of these programs for criticism as being distracting elements in an already crowded school program" (p. 12).

Meanwhile, researchers continue to struggle with the problem of how to get people to discard an old belief and accept in its place a more comprehensive, precise and accurate practice (Hill, 1992; White, 1992). Westerberg and Brickley (1991) stated there are seven realities that must be faced when restructuring schools. These realities are:

1. Sacrifice—"True restructuring requires hard work and sacrifice from many members of the school staff" (p. 23).

2. Money—"True restructuring takes time, particularly teacher time; and time costs money" (p. 24).

3. Talk—The people involved in creating a new order of things must have time to talk to everyone in the school community and communicate well.

4. Outside perspectives—Educators cannot restructure public education by themselves.

5. Fear and rumor—"... be prepared to handle the inevitable fears and rumors
that accompany change" (p. 24).

6. Sense of humor—"Humor is necessary, especially when the going is toughest" (p. 24).

7. Political compromise—"Restructuring is a process of constant mutual adaptation" (p.25).

Numerous reports have flooded the media, condemning modern education practices. "Political concern about the quality and shape of American elementary and secondary education has reached remarkable proportions—unprecedented in the last 70 years" (Sizer, 1992, p. 20). This concern has brought about the development of several innovative options to school transformation.

Webster (1986) defined transformation as a "... change in outward shape or semblance; to change in structure or composition. Math: transformation is to change the form or value" (p. 903). Manatt (1992) stated that transformation is to create fundamental changes in the way members perceive-think-behave. One must note that a single word is overriding in all four statements, and that word is change.

Transformation is the total restructuring of schools which includes changes in people, processes and things (Knowles, 1993). Transformation, therefore, is to make a major difference and change the paradigm entirely.

John Hill (1992) remarked that transformation must be so dramatic as to break the old mold. Essentially, according to Hill, it is to throw away what we have been doing and start anew.

The New American School will emerge from the ashes of the old. ... rebirth will occur in the process of restructuring. Restructuring in
education is the designing, staffing, programming, and building of the school around learning, [italics added] the central function of every educational organization. (p. xiii)

Manatt (1992) further explained that the purpose for transforming schools is to "combine the strategic and business aspects of schools with the human and psychological issues" (p. 8). If school transformation is viewed as a basic change, then one can say with some degree of assurance that school transformation within the last decade has incorporated many changes.

Several school transformation models have been proposed to address education reforms, as follows: 1) vertical leadership teams; 2) accelerated schools; 3) curriculum renewal; 4) mastery learning; 5) effective schools; 6) dimensions of learning; 7) open enrollment; 8) statewide curriculum and testing; 9) criterion referenced testing; 10) problems based learning; 11) privatization; 12) total quality management (TQM); 13) outcomes based education; and 14) authentic assessment.

Asche (1990) stated that different authors have tried to make sense out of the rapidly evolving reform and transition scene by describing unique "waves" of reform. Michaels (1988) discussed two waves of reform while Futrell (1989) said that we are entering a fourth wave of reform. Manatt (1993b) identified three waves of reform.

The first wave began in 1984 at the local education agency level. The mandate of most special local board of education meetings were to always raise graduation requirements. Usually these requirements included three years of mathematics, four years of science (biology, chemistry, physics) to some extremes of four solids (mathematics, English, science and social studies) for four years.
Attendance rules were also stiffened in the process. The backlash was inevitable and fairly predictable. Students and parents protested loudly about the 4x4 curriculum, dropout rates skyrocketed and school boards backed down to parents who demanded attendance waivers. Sizer (1992) referred to this first wave as the oblique strategy.

Wave two, according to Manatt, originated from the governors' mansions and the states' legislatures. This era sought better teachers who would not only be paid more but also be held accountable for what was taught and learned. Universities and their respective professors of education assisted state education offices to establish teacher performance evaluations in all 50 states. The second wave took on many new twists during a brief period which lasted from 1984 to 1990: career ladders, pay for performance, job enlargement, portfolios, and extra quality points. However, student achievement didn't increase all that much and many teachers and their respective organizations were very unhappy. This second wave was identified by Sizer (1992) as direct strategy.

The third wave of school reform—which we are presently in—emanated from the National Governors' Conference, the Business Roundtable, and the White House. The third wave constituted a big change in philosophy and a new flow of logic which entailed: a) setting goals or outcomes for schools; b) allowing educators and schools a great amount of leeway in how they meet the goals or outcomes; and then c) holding them accountable. The goals were to be "world class" and accountability was the requirement through which public officials, employers and taxpayers. School officials sought to prove the educational impact of the capital invested annually in
education. Unfortunately the "world class" goals have never been clearly defined and there is no clear consensus on what this means. Sizer (1992) referred to this third wave as the systemic strategy.

The critical issues facing education today are: a) dropouts; b) at risk students; c) assessment; d) outcomes and standards (Banach, 1992; Prado & Armstrong, 1989). When speaking about standards, Corrigan (1993) claimed that teachers are not capable of solving the crises. Banach further stated that, "Thirty-two years of continued failure (1960-1992) established this reality" (p. 3).

The term cultural lag has come into being in the norm-referenced test arena. Frequently both students and workers are confronted with new knowledge, new standards and new expectations. When these realizations are recognized, implementation occurs; however, publication is usually seven to 10 years later. Harkins (1992) eluded to this problem when criticizing the publication lag time. Furthermore, the testing centers normally lag behind the publishing time which severely sets standardized normative tests behind what is actually happening in education. Ornstein and Gilman (1991) mentioned this problem in their contrast of norm-referenced and criterion-referenced tests. They pointed out that the test content for norm-referenced tests is from published materials based on expert opinion. They also concluded that, "... studying for a norm-referenced test does not help much" (p. 293).

Another argument often heard is that the standardized normative tests were testing the right material, however, teachers were teaching the wrong material.
Whichever side of the argument is most convincing is irrelevant, the point being that the lack of curriculum alignment (written curriculum = taught curriculum = tested curriculum) has contributed to the apparent disaster in education.

Harkins (1992) stated it best when addressing the issue of curriculum alignment and the learned curriculum:

When there is a bad match between the tested curriculum and the taught curriculum, test results will tell us little about what students learned in class. We have a good sense of what they did not learn, but we do not know what they did learn, if anything. (p. 56)

Researchers often have concerns about teachers using the textbooks as the curriculum. Harkins (1992) recognized the problem and stated very clearly that the textbook selection process needs attention. Harms and Yager (1981); and Weiss (1987) very bluntly stated that most teachers (90 percent) remain wedded to their textbooks.

Over the years, the SIM directors have developed a format and process whereby each subject and grade level is curricularly aligned. Manatt (1993a) clearly outlined the curriculum design:

The philosophy is a set of beliefs about a curriculum area. At present, these beliefs are local but influenced by national trends, state curriculum guides and the work of academic societies. Strands are themes within a curriculum area (say, measurement in mathematics). These will vary markedly as standards are set nationally and understood locally. Program goals provide "guiding stars" within a strand and also may vary with the impact of national outcomes and tests. Finally, the scope and sequence grid is the heart of curriculum design (or redesign when driven externally). The scope and sequence grid is a list of skills, concepts, and understandings placed in a format which displays the articulation of them. The "bottom line" of a scope and sequence chart is the provision of learner outcomes written in behavioral objective format with a clear labeling of whether the objective is "initiating,"
"extending," "mastery," or is intended to "maintain mastery." These learner outcomes should also be written to the appropriate levels on Bloom's, Krathwohl's, or Simpson's taxonomies of educational objectives. (p.19-20)

The work of the past focused mainly on academic subjects (mathematics, social studies, the sciences and English or language arts). Recently SIM has been given the opportunity to guide curriculum renewal in physical education and the related psychomotor aspects of evaluation. The use of the SIM model has been linked to the success in raising student achievement in the basic subjects of arithmetic, science and social studies (Manatt & Holzman, 1991). Can similar results be expected in practical areas as found in vocational/technological education?

The present investigation deals specifically with the vocational/technology area. With the focus on vocational/technology education, the ultimate goal is to raise student understanding and achievement (the learned curriculum), (Harkins, 1992), as measured by gain scores. A secondary goal is to determine if there is equal opportunity for achievement by all students and participants. There are three groups of teachers in the curriculum renewal, alignment and assessment project (SIM II).

The three groups of teachers are as follows:

1. The teachers who have no part in developing the curriculum but receive instruction on the renewed and aligned curriculum through professional development.

2. The teachers who develop the new curriculum.

3. The teachers who develop the new curriculum and develop the test items.

The main question in this part of the research is: Do students with instructors
from each of the above three areas have an equal opportunity to achieve as measured by student gain scores? Madaus (1988) noted that measurement driven instruction is nothing more than psychometric imperialism, therefore, other alternatives need to be found.

While there is ample evidence that much has been written about vocational/technology curriculum and evaluation, there has been little research done with criterion-referenced testing and non-traditional assessment. Curriculum renewal has been a forerunner in the vocational/technology area, with the major progress being made by commercial organizations. Curriculum alignment is noticeably missing from the research. However, it is interesting to note that commercial curricula have attempted to enhance alignment by providing objectives linked to lesson plans and job sheets with the competencies being tested (e.g., Association of General Contractors of America).

Wenig (1991), and Murphy and Wilson (1989) strongly suggested that the complex world today requires everyone in society to be literate. Wenig further stated that: "Being literate is more than learning to read, write, and use math—it includes learning computer skills and having considerable understanding of technology, its dimensions, and its characteristics" (p. 24).

One of the most recent developments in vocational/technology education is the attempt being made to integrate with the academic areas. Meading (1992) stated that: "A strong tie between theory and technical application gives value to academic learning and creates an incentive for students to retain academic instruction" (p. 27).
Martin & Killeen (1992) claimed that the integrated curriculum provides learning activities which will develop interpersonal, mathematic, scientific skills and social dimensions to prepare students to become more productive citizens in a rapidly changing technological society. The outcome of integration is to improve the reading, mathematics, science, technical and problem-solving competencies of vocational students (Bottoms, 1992; Hull & Parnell, 1991). Bottoms also stated that from "The enormous amount of data being collected ... evidence that the ... key practices (in integration) help advance the academic achievement of students taking a vocational major" (p. 70).

There is increasing evidence that Carl Perkins money is funding integrated curricula and many vocational/technology education programs are now being integrated with academics. In the words of Brand (1992), "Another direction in which the vocational-technical education system is and should be moving is in the integration of academic and occupational curricula" (p. 5).

**Curriculum Theory and Development**

Walker and Soltis (1986) contended that curriculum theory, being closely connected with personal views of what is true and important about ourselves and our world, reaches far down into our inner selves, social and cultural depths. When developing curriculum, expressions are made on what we believe is true and important. This can be risky; we run the risk that others may disagree or oppose us, and we may come to question our own beliefs. Yet we cannot avoid this risk as educators, our youth and our future depend upon it.
Curriculum theory

Taba (1962) defined curriculum as, "The total effort of the school to bring about desired outcomes in school and out-of-school situations" (p. 2). Taba continued by stating that, "Curriculum is a way of preparing young people to participate as productive members of their culture" (p. 9). Wolansky (1992a) expanded upon this point by indicating that a technological culture may require a greater development in scientific knowledge and skills than does a non-technical culture.

Taba (1962) stated, "Those who work in curriculum development need to look closely at the path they have been following in order to see more clearly where it is leading, and to chart the possibilities for future ends" (p. v). It is especially important that the theoretical aspects of curriculum development be re-examined because of the strong tendency to assume that the theoretical foundations of our current curriculum are solid and that the difficulty occurs mainly in translating theory into practice (Taba, 1962; Wolansky, 1992a). Educational planning for all age groups must address the serious question as to how can the complex educational process contribute to the realization of human potential in any society (Wolansky, 1992a).

McCutcheon (1985) stated that there was a big disparity between theory and practice in curriculum work. To reduce the gap, there were a great deal of problems: what to teach; how to organize the work; how to generate continuity, integration, and coherence in curriculum; how to discern what is being learned in classrooms; how to provide written information that people can and will use; and how to develop
theories that are both appropriate and significant in facilitating an understanding of curriculum matters.

Shulman (1990) took the scenario one step further by stating that there is also a gap between the written curriculum and what is actually taught.

Curriculum and teaching have long been treated as opposites, akin to hot and cold, war and peace, or sadness and joy. Curriculum dealt with the carefully planned organization of the subject matter in the form of written materials, units of instruction and other stable products of deliberation, design, writing and editing. Teaching on the other hand, was interactive, swift, episodic and spontaneous. Though often planned, it was typically adaptive and reactive. While curriculum might be a backdrop for teaching the two were not to be confused. (p. vii)

There is clearly a need for the development of curriculum theory and practice to be in concert with one another. In a presentation addressing this issue, Pierce urged that "Field experience should be the chief basis both for the application of established theory and the development of new theory" (Beauchamp, 1975, p. 21).

The principles and particular theories regarding the nature of the individual, the nature of learning, the goals of one's culture, and the role of the individual in that culture are derived from philosophy and psychology (Wolansky, 1992a; Blair et al., 1968). The eclectic curriculum model (Zais, 1976) clearly indicates that curriculum is rooted in philosophical assumptions acceptable to society (see Figure 1). A curriculum developer needs to be aware of what philosophical assumptions undergird the educational system. Wolansky emphasized the major role philosophy plays, and stated that theories of child development and philosophical assumptions about human nature all influence education.

Although a number of instructional technologists and designers moved
Figure 1. Eclectic model (Zais, 1976)

curriculum theory into practice, the scientific approach is still the major technique used to implement curriculum work in schools. MacDonald (1977), from the vantage point as a scientist, suggested that there are three types of curriculum theory: a) control; b) hermeneutic; and c) critical.

MacDonald explained that control theories center on practice. The curriculum development procedure of control theory is based on the linear-expert model. In short, the curriculum development begins with specific goals, progresses to content and learning activities, and culminates with evaluation. Hermeneutic theory accentuates ideas and thoughts. Hermeneutic theories provide new perspectives,
viewpoints, interpretations and positions of the human condition. Critical theory deals with both perspective and practice as well as both understanding and control. Critical theorists concentrate on the dialectical relationship between theory and what is practical.

**Curriculum development**

In recent years, educators have realized that life-long learning is necessary to prepare students to function in an increasingly complex society. It is understood that advanced societies require extended periods of educational learning. Wiem (1991) drives the point home by stating "... we can no longer be content with teaching students to remember a fixed body of knowledge; instead we must help them to master techniques of problem solving and habits of continuous learning [italics added]" (p. 5).

Together with life-long learning the issue of depth vs. breath must also be taken into consideration. Experts agree that it is necessary to master the fundamentals, yet have sufficient breath which gives the students the opportunity to acquire a wider knowledge of technical subjects. The students must learn the three R's as well as the fundamentals of the technical courses and yet have some time to experience and perform skills.

The question becomes, at what point in providing breadth do teachers sacrifice essential fundamentals? On the other hand, breadth provides for the scope of human abilities. The wider the range of stimulation to which students are exposed, the greater the chances that potentialities in the student will be brought forward.
Breadth also provides a magnificent opportunity for achievement.

Wolansky (1992a) stated that it is important for vocational educators to consider what constitutes the appropriate breadth and depth of courses in a curriculum. This is sometimes referred to as a diversity of course offerings as opposed to limited choices. The use of levels, scope and sequence of content may have a different focus, thus providing for different levels of ability, interests and student goals.

Curriculum developers need to be concerned with the long-term acquisition of usable bodies of knowledge, intellectual skills, motor skills and the development of the ability to think creatively, systematically and independently (Wiem, 1991; Wiles & Bondi, 1979). Curriculum developers and instructors must organize, sequence and present learning experiences including the degree of meaning to the student so that an appropriate balance between conceptual, psychomotor, and affective learning will enhance educational orientation.

Tyler's work in curriculum (1949) raised four fundamental questions:

1. What educational purpose should a school seek to achieve?
2. What educational experiences can be provided that are likely to achieve those purposes?
3. How can those educational experiences be effectively organized?
4. How can it be determined if those purposes are being achieved?

Methods of curriculum development can be grouped and classified in a variety of ways. Klein (1986) believed that the majority of curriculum scholars have
promoted the three most commonly used schools of curricula: subject-centered, societal-centered and individual-centered. Based on the obvious needs of educational reform or the dire need to improve the quality of learning, the Center for Educational Research and Innovation of the Organization of Economic Cooperation and Development (OECD, 1975) identified two categories; system-based and subject-based curriculum development. Writing about the same concept, Tyler (1949), identified three data sources which must be used in curriculum development: society, student, and subject matter. These three data sources have historically inspired alternative conceptions of curriculum and the development of different curriculum designs.

In another analysis of curriculum development theory, Doll (1986) identified five curriculum designs. The first category of curriculum design dealt with specific competencies. The rationale for this strategy was Doll's disbelief that specific competencies should be the basis of learning activities in the curriculum domains of personal development and human relations.

The second curriculum design identified and focused upon academic subjects or disciplines. This approach was based upon bodies of knowledge that are presented as subjects or disciplines. It was an easy way to provide curriculum from which a school could be organized. The obvious problem to this approach is the tendency in the area of curriculum development to create "subjects."

The third curriculum design identified and focused on the social activities and concerns. A curriculum developed on this basis would fall into one of the following
three categories: a) the social functions or areas of social living or persistent life situational approaches, e.g., *AIDS and human sexuality education*, etc.; b) the theory that the curriculum should be developed around aspects or problems of the community or school, e.g., *school closure*; or c) the social action or reconstruction theories, e.g., *diversity*.

The fourth curriculum design focused upon process skills. This technique was based on the process by which students learn. This curriculum design maintained that people who are process-orientated are able to handle themselves better in circumstances where specific bits of knowledge are useless.

The last curriculum design centered on individual needs and interests. This approach was based on activities which used student interests and human needs. In explaining a framework of curriculum development Hunkins and Ornstein (1988) stated:

*Horizontal organization engages the curriculum worker with the concepts of scope and integration, that is, the side-by-side arrangements of curriculum components. Scope specifically deals with the breath and depth of content. Integration emphasizes the "blending" of various content topics and themes. Vertical organization centers on the concepts of sequence and continuity. Sequence is the arranging of curricular elements through some particular logic . . . Continuity deals with the vertical manipulation or repetition of curriculum components. (p. 52)*

Curriculum concepts that deal with both vertical and horizontal relations must be kept in balance. Hunkins and Ornstein (1988) stated, "Balance refers to assigning the appropriate weight to each aspect of the curriculum design." Furthermore, "A balanced curriculum is one in which students have opportunities to master knowledge
and to internalize and utilize it in ways that are appropriate for their personal, social, and intellectual goals" (p. 52).

Curriculum framework as compared to theory serves as a workable structure to accommodate changes in content as new developments and insights emerge. Two curriculum frameworks which are emphasized in the literature are as follows.

**ITECO curriculum development model (ICDM)**  The framework of this model, developed by the International Technical Education Curriculum Organization, is divided into six processes in developing a curriculum: Research; Development; Production; Validation; Installation and Client (Figure 2).

In the research stage of the framework, the developer conducts (man) human power analysis, job task analysis, and instructional analysis to determine the main knowledge and skills of a job, in an effort to ascertain the curriculum outline.

The developmental stage involves designing technical and visual information, integrating content, artwork and transition, developing text and illustrations, and performing developmental testing. It is suggested that through these steps the curriculum will become a practical tool rather than a compilation of ideas.

The purpose of the production stage is to produce camera-ready materials, perform a quality control review and reproduce and ship materials. Within the validation stage which follows, the steps are as follows: integrate logistical support, field test materials, evaluate effectiveness, and revise materials.

After the validation has taken place, the curriculum developers need to concentrate on the installation and delivery of the validated materials. The following
Figure 2. ITECO curriculum development model (ICDM) (Kline, 1984, p. 4)
step would be the inservicing of instructors for the utilization of materials as well as monitor material usage.

The final stage of this model takes place when the client authorizes the scope of the work. The purpose is for the developers to provide logistical support and the client to receive the final product(s).

Throughout the curriculum development following this framework, it is intended that the feedback function needs to operate every step of the way. In this way each stage receives feedback responses from real situations and the emphasis is to continue to improve the curriculum.

Finch and Crunkilton curriculum development model Finch and Crunkilton (1989) developed a curriculum framework consisting of three main components: a) planning the curriculum; b) establishing curriculum content; and c) implementing the curriculum.

The planning stage of the curriculum calls for the curriculum developer to establish a decision-making process to collect and assess school and community related data.

The curriculum content stage is used to develop strategies to determine curriculum content and develop curriculum goals and objectives. In the last stage of the framework the developer implements the curriculum. In this specific stage the developer needs to identify and select the materials, develop materials, initiate competency-based education and evaluate the curriculum.
Factors influencing curriculum development

Humanpower is one of the most important forces affecting the curriculum design in vocational/technology education (Zuga, 1992; Poland, 1975). In an effort to find and close the void between manpower planning and curriculum construction, Poland maintained that the curriculum developer must be cognizant of current public resources, current and future job trends and the means and methods available for curriculum construction.

Ohanneson and Vanghan (1975) viewed employment data for each occupational category as reflecting (1) current employment; (2) anticipated industrial growth; and (3) personnel replacements. For any specific occupational cluster, Ohanneson and Vanghan maintain that supply can be subtracted from demand to determine the net training need. District vocational planners can keep the occupational advisory committee informed of the net training needs data which will help them in the selection, review and evaluation of programs.

Skinkle (1984) underscored the use of advisory committees which "Have the capacity to provide insightful, up-to-date, detailed information for program development and improvement" (p. 198). To remain current in the field Skinkle suggested:

It should be noted that after developing the initial competency list for a training program, it is desirable to update the list periodically, perhaps yearly. It is also important to continue the active involvement of the advisory committee with the program. If this group meets four times a year, one of the meetings could be devoted to reviewing the competency list to determine if there are new technological changes that need to be incorporated into the curriculum. (p. 198)
Establishing curriculum content

Content in terms of key organizers or ideas, concepts, principles, laws and other forms of information is imperative for every technical subject and continues to expand with more complex technologies. A major question is: What should be the content of knowledge and skills for a high school vocational/technology curriculum?

Some leaders insist that knowledge should be derived from industry, while others feel it should originate from technology. Still others in the vocational/technology area argue that content should be based on praxiology, the production of goods and services for the benefit of humans. However, some authorities agree to subscribe to identifying key concepts and principles in given technological clusters which have survival value. The decision-making process will depend upon which sources of content are agreed upon. If one elects industry as the prime source of content, then the content will be more productive and material-oriented as well as organizationally based. If technology is accepted, it becomes more knowledge and process-oriented (Wolansky, 1992a).

Once the sources of content are established, one still needs to create taxonomies to organize the content. There are several important factors related to organizing content. The scope and sequence need to be specified. Specifying what is to be taught at a specific grade level (scope) needs to be followed by the consideration when it is to be taught (sequence). Tyler (1974) listed three criteria for effective content: a) organization or continuity - referring to a vertical reiteration of major curriculum elements or scientific principles; b) sequence - meaning progressive
development of understanding, skill or attitude; and c) integration - denoting the horizontal relationship of curriculum experiences to provide a unified view.

In organizing the content to formulate a curriculum there are a series of steps a developer could follow. Taba (1962) had six basic steps while Barton (1984) developed an eight-step model. Taba began by diagnosing the needs and Barton chose to identify the school goals. The second step for both Taba and Barton was the formation of objectives and the creation of subject goals respectively. Step three was similar and Taba chose to call it selection of content while Barton referred to it as the creation of subject content scope and sequence charts. Step four in Taba’s model organization of content is essentially part of Barton’s step three, scope and sequence. Barton’s step four differs in that the developer identifies the competencies. Step five for both developers is similar, focusing on the selection of learning experiences and compilation of curriculum guidelines. Step six is close in nature. Taba chooses to call it the organization of learning experiences while Barton uses the terms identification of instructional objectives. Step seven for both Taba and Barton focuses on curriculum evaluation. Barton’s eighth step is curriculum revision while Taba does not address this issue.

The use of these guidelines helps instructors organize courses which exhibit consistency and continuity. Teachers need to be able to make informed decisions based on theories of learning, the nature of knowledge, cultural orientation, individual development and philosophical assumptions.
**Task analysis**  Task analysis is the process of synthesizing the knowledge and skills required to perform the tasks that have been previously defined in the job analysis. Very few content determination strategies have seen such a widespread use as task analysis. First, the job analysis sketches the outlines and "high spots" of the job to be taught. The next step is to perform a task analysis to refine the specific steps to perform the job. A task generally requires some combination of skills and knowledge; that is, it requires both mental (knowing) and physical (doing) action on the part of the worker. Each task has a definite starting and ending point. Jobs usually consist of a series of interdependent tasks, and the tasks would normally be completed in proper sequence if the job is to be done satisfactorily. Task details are considered the smallest unit of job activity and each has a specific purpose to complete a step-by-step process to finish a job. Thus, task analysis is the process of identifying the set of actions or job elements required to perform a specific work role. It is a scheme which details how the job will be done and it involves a logical sequencing of the job elements.

Mager (1988) declared that:

You have determined that there are things that students should be able to do that they cannot do now, and you want to determine what is worth teaching. This will be accomplished, in part, by deriving the important outcomes of the instruction from the tasks to be learned. (p. 29)

Smith (1982), on the other hand, was critical of the task analysis approach and said, "Task analysts are more concerned with what gets done on the job than on the identification of the relevant skills, and knowledge required by the person who does
the job" (p. 3). Smith also stated that the content of educational and occupational training curricula was more of a guessing game than of scientific research.

Mager and Beach (1984), in their textbook, *Developing Vocational Education Instruction*, proposed a practical suggestion on course development. The first step describes, in general terms, that which one does when performing the job. The second step defines job performance in finer detail, listing each of these tasks (task analysis). Third, a simplified task listing sheet is presented with columns for the task statement, frequency of performance, importance and learning difficulty.

Herschbach (1976), in an article on deriving instructional content, recommended, analysis of the job focused primarily on task and task elements involved in work activity. The objective is to dissect the job activities into different skill and knowledge components in an effort to identify training content. Herschbach further stated that "... the purpose of the task inventory step is to collect background information and develop a differentiated list of significant tasks performed by incumbent workers" (p. 63).

After the completion of the task inventories the next step in content development is the description of the actions, conditions, standards and contingencies of job performance. Task analysis is one of the methods used to determine the curriculum content. This method focuses on the identification and verification of tasks performed by workers in a certain occupation. The procedures of task analysis in vocational/technology education enable curriculum developers to produce objective data related to specific worker tasks. The fundamental steps include
reviewing relevant literature, developing an occupational inventory, selecting a worker sample, administering the inventory and analyzing the collected information.

From the task analysis process (Figure 3), it is relatively easy to obtain information on what workers must actually do in their job and this needs to be considered in curriculum development. Developers of vocational education curricula

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**Figure 3.** Task analysis (Mager & Beach, 1984, p. 4)
must remember that they need to respond to labor market needs. This means: a) determine what the current and projected needs of the defined occupational categories are; b) know the number of students the present programs are preparing; and c) approximate the net need for graduates in each particular category.

Perhaps the most valuable principle in identifying competencies is to match the skills learned compared with the necessary skills to progress to the next skill level. An important aspect to consider is that dormant skills rapidly diminish over time. Competency or performance based learning relies on task analysis to ensure that relevant skills and knowledge required by the person who does a particular job are acquired. One problem is to obtain and analyze data for the actual job requirements which, however, may be in a state of flux.

For any job there are generally a number of tasks, a larger number of sub-tasks, and a much larger number of skill and knowledge requirements. If one examines a variety of jobs, it soon becomes apparent that the list of tasks and sub-tasks grow exponentially while the list of knowledge and skills requirements only increases marginally (Smith, 1982; Wolansky, 1992a).

While the tasks across occupations may reveal limited similarities, one discovers a high degree of commonality between many jobs. This finding serves as a justification to prepare individuals in high schools for a family or cluster of occupations rather than specific jobs. It is purported that skills and knowledge derived from technological clusters prepares workers to adapt to changes in technology and enhances their working careers.
The DACUM approach

Considered to be the most useful variant of introspection is the DACUM (Developing A CurriculUM) approach. This method utilizes some basic ideas associated with introspection but shares only a few of its shortcomings. The reason for this is that DACUM relies heavily on experts employed in particular occupational areas to determine curriculum content and allows the experts to be guided through a systematic content determination process.

DACUM was initially created as a joint effort of the Experimental Projects Branch, Canada Department of Manpower and Immigration, and the General Learning Corporation. The idea was later adopted by The Ohio State University and utilized in the determination of technology curriculum (Adams, 1975). Adams asserted that DACUM may be defined as, "A single sheet skill profile that serves as both a curriculum plan and an evaluation instrument for occupational training programs" (p. 24).

The DACUM approach to curriculum development has definite advantages:

1. The expert committee procedure results in a relatively low development cost.
2. The time frame for conducting the DACUM activity is relatively short.
3. DACUM allows curriculum content to be derived without the aid or employment of professional curriculum writers.

DACUM's advantage over the traditional introspection process is certainly clear. The process allows more up-to-date and relevant content to be identified and incorporated into a curriculum. At first glance, the DACUM method appears no different from the traditional trade and job analysis process. A closer observation
would show that traditional approaches rely on the instructor to determine what the content should be with little direct consideration given to input from persons employed in the actual occupational setting.

**Curriculum Evaluation**

Sharpes (1988) stated: "The most important decisions about a schooling program, like curriculum, is not just whether or not it seems to work when it is completed, but if it doesn't work very well what should be done" (p. 96).

**The need for curriculum evaluation**

There is a growing demand and need to improve research evaluation methods to contribute toward improving curriculum and instruction. The Joint Committee (1981), defined evaluation as a systematic investigation of the worth or merit of an object; e.g., a program, project, or instructional material.

It is necessary to separate the entities being evaluated (English, 1992; Wolansky, 1992a); Klein, 1986). Evaluating instruction may mean evaluating instructional materials such as textbooks, modules, multimedia learning packages or specific methods of instruction which contribute to student achievement. Furthermore, the entity may be much larger such as evaluating the effectiveness of a program (Wolansky, 1992a). In such a case, student characteristics, program attributes, intended outcomes and actual outcomes are assessed.

Tyler (1949) devised a rationale for developing curriculum and a plan of instruction, accentuating the importance of evaluation. Tyler stated that evidence
obtained from evaluation leads to further consideration for improvements of objectives, learning experiences and organization. Tyler noted further that when evaluating a program it is important to raise critical questions such as:

1. What will be evaluated?
2. Why will this entity be evaluated?
3. How will the information or data be obtained?
4. For whom are the evaluation results intended?
5. What resources are available to perform summative evaluations?

Evaluation is usually seen as a means of both understanding an educational program and improving it. Tyler clearly saw the need to identify and appraise factors in the environment that have significant influence on learning as well as the planned curriculum and the activities of the teacher. The need to access, measure, evaluate or describe such matters as classroom ethics, the learner's expectations, the teacher's concern for the students and the expectations the teacher has of the students are illustrations of some of these environmental factors.

Tyler also emphasized that the conception of evaluation has two important aspects; a) it must appraise student behavior, and b) it must involve more than one appraisal to determine change. For example, administering a pretest prior to instruction and a post-test after instruction should reflect any achievement.

Wolansky (1992a) concluded that it is important for the evaluator(s) to survey the statement of objectives, content coverage, reflection of test instruments to the objectives and students previous performance records. Also important are the
instructional methods employed, the attitude of students toward instruction and which testing or evaluation means and instruments are best fitted for instructional assessment.

**Tyler model for program evaluation**

Tyler (1974) asserted, "Evaluation is also an important operation in curriculum development" (p. 104). An entire chapter is devoted to this topic. The simplest model is that of input, process and output (Figure 4). A model such as this recognizes that a teacher can, to a certain extent, control what can transpire in each of these three components.

When a decision has been made to carry out a program evaluation then the input, process, output and feedback loop can be extrapolated further.

![Diagram of Tyler evaluation model](image)

*Figure 4. Tyler evaluation model (Tyler, 1974)*
Input would include:

1. The purpose of the evaluation.
2. What information or data is required?
3. What design is appropriate?
4. What instruments are available?
5. What additional instruments are required?
6. Who will be involved to execute the evaluation?

Process would include:

1. What procedures are appropriate?
2. Who will provide the information and data?
3. What analysis is appropriate?
4. How will the findings be reported?
5. To whom will the results be available?

Output would include:

1. The purpose of the evaluation.
2. The variable measured.
3. The procedures used.
4. Students and programs included in the evaluation.
5. The relevant variables - time, achievement, costs.
6. Recommendations and limitations.

Tyler said, "As a result of evaluation it is possible to note in what respects the curriculum is effective and in what respects it needs improvement" (p. 105). The
learner outcomes stem from instructional needs and involve a considerable number of variables including variations in the learning styles of students, the environmental conditions, the skill of the teacher and the academic expectations of the entire school. It is also essential to evaluate the student’s growth and development in the cognitive, psychomotor, affective and perceptual domains. Knowledge, skill, attitudes and habits are important aspects in vocational/technology education.

**CIPP (context, input, process & product) model**

Stufflebeam (1967) developed (cited in Madaus, Scriven and Stufflebeam, 1983) the CIPP model for evaluation which brought forth other new conceptualizations, especially those developed by Scriven (cited in Madaus, Scriven and Stufflebeam, 1983). The CIPP approach is based on the philosophy that the most important purpose of evaluation is not to prove but to improve. Four stages have been classified in relation to the CIPP objectives, methods and uses:

1. **Context Evaluation** - The primary purpose here is to identify some strengths and weaknesses of the program and to provide direction for improvement. A mental grasp of the results of context evaluation will provide a sound basis for adjusting existing goals and priorities and targeting needed changes. Context evaluation has a number of constructive uses such as formulating objectives for staff development, making curriculum revisions and helping students and their parents focus their attention on developmental areas where more progress is needed.

2. **Input Evaluation** - The main objective of input evaluation is to decide what
resources and strategies will be utilized to achieve program goals and objectives. The main intent of input evaluation is to help program evaluators consider alternatives in the context of their needs and environmental circumstances and to entail a plan that will work. Input evaluations can be used to assess existing programs—whether they are functioning as intended or not—against what is being done elsewhere and proposed in the literature.

3. **Process Evaluation** - The purpose of process evaluation is to provide feedback to staff the extent to which the program activities are on schedule, are being carried out as planned and are utilizing the available resources in an efficient manner. Process evaluation provides and exhaustive record of a program that was actually implemented and how it compared to what was intended. This evaluation can be used to measure what effect the program has on the students in a particular school.

4. **Product Evaluation** - The objective of a product evaluation is to measure, interpret and judge the attainments of a program. The purpose of a product evaluation is to determine the extent to which the program has met the needs of the group it was intended to serve. A product evaluation provides direction to modify a program so that it better serves the needs of target audience.

The aforementioned aspects of evaluation employ a gathering of data which is used to make decisions. Collectively they represent a means of providing teachers and administrators with the kinds of information that are most useful as feedback for curriculum improvement.
**Darcy's model**

The method of Darcy's evaluation model is to improve the program by looking at process and then rate it by assessing the outcomes. In using this model teachers may select resources, identify goals and apply particular processes and strategies such as pre-testing within a given context for a particular group of students. In the process module, time on task, individual and group efforts, theory/practice sequences and individualizing instruction are some of the processes which can be varied. Within the output component, the actual results achieved are compared with the intended outcomes or goals. Critics argue that with this model it is difficult to establish an objective external criteria or comparative standard (Doll, 1986).

**Educational Curriculum and Assessment Models**

A common orientation to skills development in the curriculum is provided by Bloom's Taxonomy of Educational Objectives in the cognitive domain. Bloom's taxonomy is a hierarchical construct that classifies learning into six levels in ascending order: knowledge; comprehension; application; analysis; synthesis and evaluation (Figure 5). Ellis et al. (1988), submitted that the most favored instructional use of the taxonomy is a means of structuring learning activities in such ways as to ensure that students not only acquire and understand information, but that they are able to apply and examine ideas divergently as well. Therefore, one obvious value of the taxonomy is that of accounting in advance for a range of skill development across an intellectual continuum.
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<tr>
<th>Level of Cognitive Ability</th>
<th>Question Type</th>
<th>Student Expectation</th>
</tr>
</thead>
</table>
| Easier                    | Knowledge     | a) regurgitation of facts  
                         |                | b) dealing with information through sequencing, classifications and categories, knowledge of criteria, methods or processes  
                         |                | c) knowledge of generalizations  
                         | Comprehension  | a) ability to translate from one form to another  
                         |                | b) interpret the basic ideas  
                         |                | c) make inferences  
                         | Application    | a) application of what the student learned at the knowledge and comprehension levels  
                         | Analysis       | a) of what someone says or writes  
                         |                | b) of the relationship between the elements  
                         |                | c) of the overall structure  
                         | Synthesis      | a) produce some form of communication which reflects the student's own ideas and feelings  
                         |                | b) plan a solution to given situations  
                         |                | c) generalize based on information given  
| Harder                    | Evaluation    | a) analyze conclusions  
                         | (performed throughout all the levels) | b) make judgments about these conclusions  

Figure 5. Bloom's taxonomy of educational objectives (Adapted from Bloom, Englehart, Furst, Hill, & Krathwohl. *Taxonomy of Educational Objectives, Handbook I: Cognitive Domain*, New York: David McKay, 1956, p. 461)

**Competency based education (CBE)**

The overwhelming trend in occupational preparation programs is the use of competency based vocational education (CBVE), sometimes referred to as competency based learning (CBL) or individualized competency based learning (ICBL); with the earliest version known as competency based education (CBE). Such
an approach to curriculum development and implementation has been particularly
dominant in Canada, yet according to Reynolds and Sharpe (1992) there is little
empirical evidence from evaluative efforts that address this approach.

The premise of competency based programs is that all students will achieve a
minimum preset level of accomplishments in each skill or knowledge area. Each unit
or competency can be evaluated individually to determine student proficiency.
Delivery methods may vary from traditional lectures and group work to learning
activity packages. However, the most common approach for CBL is through varying
degrees of individualized instruction, hence the name ICBL.

The advantages of competency learning are that students may progress at their
own individual pace, extending the time if needed or lessening the period of time
with studious discipline, or by testing out of competencies. One of the major
purported advantages of competency based instruction (CBI) according to Andreyka
(1985) is the open-entry and open-exit options available. On the other hand, Brook
(1989) stated that the major disadvantage of competency based programs is the vast
amounts of time that are taken up in transition from regular programming to
competency based. Brook continued by suggesting ten steps to follow in converting
to competency based learning.

1. Be sure administrators at all levels are committed and knowledgeable
   of CBL.
2. Develop an institutional model.
3. Develop a systematic implementation plan.
4. Establish realistic timelines.
5. Have a dedicated and capable instructional administrator lead the
   implementation.
6. Provide adequate resources (quantity and type), including staff
7. Provide incentives and rewards for faculty.
8. Don't expect everyone to "jump on the bandwagon."
9. Anticipate and deal with non-changing conservative attitudes.
10. Provide accurate information to counteract misinformation. (p. 5)

Johnson (1993) contended that the problem with competency tests lies in the difficulty in interpreting test results. Johnson asked the following questions, "What does the test score actually mean? What cut score distinguishes poor performance from adequate performance?" (p. 10).

There are other criticisms of competency testing (Ellwein, Glass, & Smith, 1988; Smith, 1988). Through ethnographic investigation several key points surfaced relative to the appropriateness of tests for making critical education decisions. First, it was found that test standards are set according to how many students should pass rather than on what should be known. Second, "safety nets" (cut-off points resulting in a lowering of standards) are common when tests are used for decision making. Safety nets are used to protect the examinees and to prevent large numbers of people from failing. Third, it was noted that competency tests and standards serve as symbolic and political gestures of quality in education.

Subject integration

"It is generally accepted that traditional education is no longer relevant to the real world" (Stephens, Blough, Jones, & Van Dyke, 1993, p. vi-1). The authors go on to explain that there is a loss of relevance in education partly because of the fragmented curriculum compared to the un-fragmented universe. The solution to this fragmentation they say is an integrated curriculum which makes various school
subjects fit together to reflect the way experiences fit together to form the real world.

Martin and Killeen (1992) pointed out that subject integration is designed to develop the knowledge, skills and techniques which can be applied to future careers and educational pursuits:

... to become technologically literate as related to business, career and personal uses; to develop and demonstrate appropriate decision making, problem solving and creative abilities; and the ability to integrate and apply knowledge and skills learned in other classes to the solution of selected "thematic" learning activities. (p. 2)

Education has become more specialized in recent years, allowing a greater depth in instruction. Maeding (1992) contended that this has been successful, in general, in all but one respect: "It has created a chasm between the theory taught in various subjects and the practical applications of those theories" (p. 26). Meading continued by giving an example of the higher math courses taught in a typical high school. Algebra and geometry, Maeding stated, have extensive technical applications in vocational/technology programs. However, the author claimed most students are oblivious to the practical applications of math theories outside of the narrow scope of their classrooms.

Meading also maintained that there must be a strong tie between theory and technical application. This, Meading insisted, gives value to academic learning and creates an incentive for students to retain academic instruction. There is an intuitive understanding of the connection between academics and applying knowledge to create value. In short, Meading explained that the technical courses have more value for a student when technical instructors stress and value students' academic
education. Berulava (1992) reinforced this statement in a Russian study, stating: 
"... the integration of general and vocational education ... becomes an important 
factor in the integral preparation of students for life and labor" (p. 13).

The literature revealed that there are two types of integrated curriculum plans; 
a) the interdisciplinary theme plan—the practical arts integrated with academic 
education, referred to as vertical integration, and b) the intradisciplinary theme plan, 
the integration of academic subjects (e.g., science, health, & language arts) or the 
integration of vocational/technology subjects (e.g., metals, plastics, & woods = 
manufacturing). The latter is known as horizontal integration.

Stephens et al. (1993) verbalized the most essential point about integrated 
curriculum. They stated that, if the curriculum is built around a central theme that is 
relevant to the real world and each subject area contributes to that theme, then all 
content areas become both relevant and mutually reinforcing.

The review of literature emphasized that the road to integration is not smooth; 
there are vast amounts of time consumed in teaming, curriculum planning, student 
and staff challenges, instructional sharing and turf protection (Berulava, 1992; 
Meading, 1992; Hull, 1992; Parnell, 1991; Stephens et al., 1993). On the other hand, 
authors reported that some of the positive student outcomes in the cross disciplinary 
approach are greater independence, absorption of problem-solving skills and 
knowledge of how to use technical books as a resource.
Tech prep

In the spring of 1985, Parnell published a book entitled *The Neglected Majority*, which proposed and defined tech prep as a viable high-school alternative to the time-honored university entrance program. Parnell called for a national movement to establish and develop tech prep as a valid and significant reform for technical education. During the next five years, tech prep was discussed, promoted, and successfully implemented by many educators—and included as a major component of federal legislation in the Carl D. Perkins Vocational Technical Education Act of 1990.

The concept of tech prep is that it is to serve secondary education population with employment requirements as well as to provide an opportunity for continuing education at an associate degree level. The tech prep/associate degree has been called the K-12...14...16 connection. When the curriculum framework clearly links secondary programs with specific postsecondary degree programs, the term Tech Prep/Associate Degree (TPAD) is commonly used (see Figure 6). In the broadest form, the Tech Prep program is designed to accomplish a number of differing goals. From the perspective of curriculum design, the most important include the following:

1. To provide purposeful educational program alternatives for students who are not well served by existing secondary and postsecondary curricula.
2. To prepare students for gainful employment upon high school graduation as well as later life.
3. To prepare students for education beyond high school, especially in Associate
Figure 6. Tech Prep Associate Degree (TPAD): The K-12... 14... 16 Connection (In D. Hull, & D. Parnell, *Tech Prep Associate Degree*, Waco, TX: Center for Occupational Research and Development, 1991. p. xx.)
of Applied Science (AAS) degree programs, but also in apprenticeships, on-the-job training, cooperative education and continuing education.

4. To attract significantly more students into careers in health, business, technology and other areas that require less than baccalaureate preparation.

5. To facilitate the movement of students from high school to college through close articulated linkages with postsecondary curricula.

6. To strengthen secondary vocational programs through the increased relevant academic content.

7. To utilize instructional methods in traditional academic areas that will encourage success in students representing a wide range of learning styles and abilities.

8. To maximize flexibility in choices of educational and career paths, and to allow students to alter paths with minimum penalty.

9. To strengthen associate degree programs with more advanced content and a greater focus on student learning styles.

10. To stimulate and apply leverage to create the changes in educational practices that are needed in order to respond to changes in society, especially those brought about by technology.

In organizing the process for an integrated Tech Prep curriculum, Edling (1992) listed the following steps:

1. Establish the broad program and student outcomes desired from the TPAD program, incorporating both community and employer expectations and student preparation for ongoing education.

2. Add a second level of detail to establish an outline of the major
student outcomes in progressive stages of the program during grades 9 through 14, but without attempting to link outcomes to specific grade levels at this time.

3. Identify outcomes that can be accomplished in basic core as well as technical or specialty core courses.

4. Identify those outcomes that are program or occupation specific.

5. Arrange the curriculum in a logical sequence and then determine reasonable dividing lines for secondary versus postsecondary levels.

6. Overlay state and local requirements for both secondary and postsecondary segments of the program, and determine how these requirements may influence the program design. Fine-tune the programs to incorporate all constraints. Define the areas where strong indications of the need for revision of requirements come to the surface.

7. Proceed with approval process. (p. 10)

Hull (1992) clearly pointed out that the individuals for whom tech prep is intended are those in the traditional vocational programs, i.e., students who are not committed to either an occupational or the traditional college prep goal, the "neglected majority" identified in Parnell's book. Hull strongly insisted that tech prep is for the experiential, extroverted and contextual learners who represent the majority of the population (75 to 80 percent).

Pollard (1992) and Feldman (1988), maintained that behind the tech prep movement is a concern that the high school curriculum is inadequate in preparing students for employment opportunities. They asserted that many students do not complete high school and those who do often lack the necessary job skills, therefore tech prep is an attractive alternative.
Total quality management (TQM)

There is a plethora of information regarding the need for quality in education and the application of business techniques to accomplish that goal. The most recently heralded idea is that of total quality and the method of delivery is imported from business and industry via Japan. The buzz word in both education and industry is Total Quality Management (TQM).

Since the late 1940's, W. E. Deming has been a familiar name in Japan. Deming's famous 14 Points and Statistical Process Control (SPC) are at the core of this philosophy. They are considered largely responsible for Japanese industry's post-World War II recovery and rise to dominance in world markets.

Dr. W. E. Deming, America's apostle of quality management, is one of those rare individuals who won the respect of American management precisely by telling executives what they didn't want to hear. Deming preached a philosophy that hinges on an intimate understanding of how processes operate and a company-wide commitment to constant improvement.

Deming's principle is an exacting, never-ending proposition that pins the responsibility for long-term quality enhancement squarely on the shoulders of management rather than on the rank and file. Quality, Deming was often heard saying, starts in the boardroom and doesn't stop until one hits the factories of every part's vendor. Milakovick (1991) stated, "Deming's TQM system is effective only if senior elected and appointed leaders are committed to change" (p. 200). It is, therefore, eminently clear that the quality movement must begin from the top. If the
top management is not tied to long-term goals and quality objectives, the work force will naturally not be part of the quality vision which management must set. One of the greatest barriers to implementation, according to Coate (1991), is the support from the top. It is essential to have a firm commitment to TQM from the president or chief of any educational institution" (p. 37).

According to Rhodes (1990) and Melvin (1991), TQM is resisted many times as a viable education management method for three reasons: a) a fear of industrial models; b) poor knowledge of work, workers, and work process in schools; and c) unquestioned beliefs.

There are five precepts of TQM:

1. Customer orientation defines quality, however, in the education arena the customers are not as clearly defined. Some TQM advocates indicate that the students are customers while others maintain the employers of the students are the customers: yet some say that both are customers, students being internal and employers external.

2. Without commitment of top level management the concept of TQM will not succeed.

3. Orientation to continuous improvement must clearly demonstrate that finish lines do not exist. Mile markers replace finish lines to illustrate steps in improvement.

4. Management must realize the synergy of teams and utilize them to their maximum. Teamwork instills ownership in a system and organization, and
maximizes what is being accomplished.

5. There is a need for empirical measures and statistics to make decisions. Gut level maneuvers are no longer acceptable as the mistakes are becoming more costly.

One way to improve quality in manufacturing is by never-ending reduction and elimination of defects. Is there a difference in education? If TQM is to have an impact on education in North America the focus will need to lie in the improvement of the process. The question then becomes: Can variability in the education process be reduced like precision measurements and adjustments of machinery in industry?

Kaufman (1992), asked the question, "Is TQM appropriate for education?" and then proceeded to answer it, "No doubt! Organizations must not only change how they do business, they must also have to reinvent themselves if they expect to survive into the next century. Sensing the urgency, education is climbing aboard the total quality train" (p. 150). A recent ASCD Update (1993) supported TQM in education by asserting that, instead of scrutinizing outcomes which are the products that roll off the end of the line, the focus should be on the integrity of the process leading to the outcomes. Kaufman summarized the process by stating, "TQM is a people process. TQM is an on-going process. It is never complete" (p. 150). A people, on-going, and never completed process is education.

**Authentic assessment**

Authentic assessment is an umbrella term used for alternative assessments. Authentic assessment may be called by many different terms such as portfolio

The caveat "Not everything that counts can be counted and not everything that can be counted counts" was reportedly posted in Albert Einstein's office (Marshall, 1992). Educators have been becoming increasingly dissatisfied with the testing efforts and what is at stake with the results over the years. This is clearly brought forward by Popham (1993) who stated, "If instruction is being driven by high-stakes testing, then we simply need more praiseworthy assessment targets" (p. 472). Wiggins justified a deep involvement in assessment, "... as somebody who cares deeply about curriculum and instruction and saw the strangleholds that assessment had on teaching" (Nickell, 1992, p. 91), and knew a need to get involved. Stiggins (1991) when tracing the history of assessment remarked:

... educational practitioners (teachers and administrators) abdicated responsibility for understanding or conducting assessments in schools, leaving it to test and textbook publishers to develop 'scientifically precise' assessment tools. The most important effect of this abdication was a functional differentiation: teachers would teach, we decided, and assessors would assess. In effect assessment and instruction were separated from one another. (p. 265)

Many researchers and practitioners feel there is an over-reliance on conventional testing and are dissatisfied with the results. In reviewing the literature, five main reasons were evident for the discontent with testing:


2. Instruction that is guided by testing tends to accentuate drill and practice activities; it doesn't focus on reasoning and metacognitive skills, which may have
the greatest benefit in terms of student outcomes.

3. Conventional tests cannot easily assess the methods students use for problem solving, the construction on mental models, and the misconceptions students may possess (Frederiksen, 1990).

4. Tests lead students to believe that there is always one right answer, problems are structured, guessing is inappropriate, and the right answer always resides in the teachers head (Collins, 1990; Kirst, 1991).

5. Tests can lead to a narrowing of the curriculum as teachers "teach to the test" and students learn what the test will measure (Frederiksen, 1990; Kirst, 1991).

In a review of educational research in assessment, Wolf et al. (1991) argued for a change from a testing culture to an assessment culture. To move from a testing culture to an assessment culture, the authors advocated adoption of the following principles:

1. Educators need to view assessment as an opportunity for learning rather than testing. With a proper approach to assessment it is believed that, not only can the need to assess the outcomes of learning be met, but also the opportunity to improve learning will be created.

2. In a testing culture, assessment is viewed as a "point-in-time" evaluation of knowledge. However, in an assessment culture, assessment is viewed as formative and ongoing (Frederiksen, 1990).

3. The testing culture emphasizes a norm referenced approach to evaluation that determines student ranks. In an assessment culture, the acceptance of a
criterion-referenced philosophy of evaluation leads to assessment focused on accomplishment rather than rank.

4. In a testing culture, learning is viewed as an accumulation of knowledge that is verified through recognition and recall tests taken in individualistic and isolated settings. In contrast, in an assessment culture, learning is perceived as a constructive process that is verified by application, use and transfer of knowledge in realistic contexts (Collins, 1990).

5. In the test culture, correctness is desired, simple and low levels of understanding are routinely evaluated, and test content is often determined by what is easy to score. In an assessment culture, the process of performance is valued beyond simple correctness. In the context of assessment teachers want students to know and do rather than what is easy to score.

Authentic assessment is considered to contain the three P's: performance, portfolio and product. Wolansky (1992b) made a crucial point, stating that the success of authentic assessment is closely linked with the writing of performance objectives, selecting content, determining emphasis based on a table of specifications (rubric), and identifying critical tasks to be learned.

Johnson (1993) made an observation that many professionals have felt but did not express, that assessment in many vocational/technology classrooms closely resembles authentic assessment. Instructors give assessments to students that are imprecise, problem centered and highly experiential. Students complete these assignments with considerable problem-solving and other intellectual process activity
as well as hands-on practice with tools, machines and material. In the duration of completing these activities, the instructors observe students in action, provide mentoring and coaching support and continually assess student performance.

In their 1992 annual meeting, The National Education Association (NEA) passed a resolution supporting authentic assessment. "The Association believes that teacher-developed tests, formal and informal observations, and student projects are effective evaluative measures - none of which should be used as the single evaluation score" (p. 29).

Unfortunately, Worthen (1993) observed that "... many practitioners are unsure whether to venture into the torrents of unfamiliar assessing [italics added] strategies or to drift quietly in education's backwaters, waiting to see if this movement crests and ebbs as quickly as have dozens of others" (p. 444).

One of the main criticisms of authentic assessment is the large cost involved when compared to conventional testing. However, Popham (1993) maintained that "... by assessing only the numbers of students and assessment tasks necessary to influence educators' instructional efforts, authentic assessment can be made affordable" (p. 470).

**Psychomotor aspects of assessment**

A near cousin to authentic assessment is that of psychomotor performance measurements. This aspect of measurement has been used for some time by the vocational/technology segment of education. Erickson and Wentling (1976), stated that: "Examples of achievement-oriented performance tests date back to 800 B. C. in
the form of Greek athletic competition" (p. 127). Although utilized to varying
degrees in this area it has probably been one of the most dominant measurement
devices.

Psychomotor assessment is commonly referred to as performance, process or
sensori-motor skills measurement in the literature. It is a manipulative skill test
requiring students to accomplish a task under controlled conditions. Such tests are
designed to assess the students ability to perform a task or series of tasks after the
student has received instruction and has had ample opportunity to practice particular
skills. Psychomotor skills involve behavior ranging from gross bodily movements to
finely coordinated maneuvers. These performances include muscular action and
require neuromuscular coordination. Wolansky (1985) stated, ". . . reflective thought
and communications play an important role in interpreting what, how, why, and when
certain actions must be executed" (p. 35).

Some tasks may require a greater emphasis on the execution of necessary
procedures or processes and less emphasis on the creation of a product. A
performance evaluation instrument may be designed to assess skills, product
evaluation, process evaluation, or some combination of both. Holloway (1982),
explained:

Effective process evaluation requires attentive and consistent teacher
observation of student performance. This process should be objectively
judged by using a performance checklist. Performance checklists should
be developed in conjunction with performance objectives, student
activities, or performance exercises. Product or outcome evaluation will
also be more effective if a product checklist is used. In product
evaluation, the teacher must objectively judge the quality of the finished
product. (p. 17)
Teachers assess performance through ratings and judgments to determine the strengths and deficiencies of an individual's performance at a particular time in a course of study. Wolansky (1985), clearly stated:

It is readily apparent that manipulative skill tests require considerable planning. At the general level, it is important that the intent of the performance objectives are clearly sampled. At the specific level, the nature of content, observable behavior, and assessment of performance must be critically formulated into a meaningful exercise. (p. 37)

Whatever terminology is used psychomotor, product, process or manipulative tests are one means of assessing student acquisition of specific skills. Students are tested under controlled conditions to evaluate performance related to speed or rate of work, quality or precision of work, and procedure compared with predetermined standards. Practical arts, physical education, home economics, science, art and music all require the learning of sensori-motor skills (Biggs & Collins, 1989; Erickson & Wentling (1976); Wolansky, 1985). Carefully designed and administered psychomotor tests can yield objective, reliable, and useful measures of student ability to perform selected tasks. Most importantly, psychomotor tests allow students an opportunity to demonstrate their capabilities which, in turn, build self-confidence and to some extent self-evaluation.

**Relationship among domains**

The three domains of learning—cognitive, affective, and psychomotor—while classified separately, are not mutually exclusive (see Figure 7). A single objective may require a student to demonstrate learning that has occurred in two or more domains. If, for example, students were required to construct an item, they would
<table>
<thead>
<tr>
<th>Cognitive Domain</th>
<th>Affective Domain</th>
<th>Psychomotor Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Knowledge Comprehension</td>
<td>Receiving</td>
</tr>
<tr>
<td>Working</td>
<td>Application Analysis</td>
<td>Responding</td>
</tr>
<tr>
<td>Qualified</td>
<td>Synthesis Evaluation</td>
<td>Organizing</td>
</tr>
</tbody>
</table>

Figure 7. Teaching your occupation to others (Bott, 1987, p. 68).

need to demonstrate psychomotor skills in building, cognitive skills in calculating the materials needed, and affective values through a demonstrated appreciation in quality workmanship.

Since most of vocational/technology education is skill oriented, the objectives are primarily psychomotor. This means that, while one objective may indicate manipulative behavior, it will also include the cognitive and affective domains. In order to perform a skill, a number of details need to be known (materials to be used, procedures, and processes), and appreciation shown (in the quality of the work, empathy, etc.) in addition to the physical act of doing (Bott, 1987; Wolansky, 1985).

Performance standards

The New Standards Project at the University of Pittsburgh Learning and Research and Development Center is headed by M. Tucker (an early proponent of national teacher certification) and L. Resnick. The New Standards Project is funded by $2.5 million from the McArthur and Pew Foundations. Manatt (1993b) stated that...
the New Standards researchers, like other proponents of outcomes and assessment reform, believe students should be measured on their progress toward generally accepted standards, not on time spent in school.

Tucker stated, "A diploma certifies that you've been there 12 years. It does not certify to any particular level of performance." Tucker further stated the project's goal: "Every kid who meets world class performance standards gets a certificate of mastery, regardless of age" (Ordovensky, 1992, p. 8A).

Support among policy makers for a national system of standards and assessment climaxed when the Congressionally appointed National Council on Education Standards and Testing proclaimed in March 1992, that the idea was both feasible and desirable. The Council called for the development of national standards in the subjects of history, geography, mathematics, science and English as well as the creation of a national system of tests linked to those standards (ASCD, 1992, p. 7).

The California Department of Education (CDE) is in the process of developing performance standards that will radically change the way high schools within the state are structured. A key feature of the restructured high school is an integration of curriculum for all students. Traditional barriers which prevented teachers across disciplines from collaborating in planning, teaching, and assessment activities will be removed. A Far West Laboratory bulletin (1992) stated: "Students must be prepared to achieve at world-class levels, to graduate from high school as self-motivated, competent and lifelong learners, equipped with the knowledge and skills to make decisions about career options" (p. 1).
Performance standards call for students to graduate from high school with an individual record of accomplishment. The fundamental feature of this record will be the student's results from the revised assessment program. This will include the following:

1. Grade 10 high school performance tests in English/language arts, mathematics, history/social science, and science;
2. End-of-course exams; and

The Far West Laboratory bulletin emphasized that "... each of these components of the revised statewide assessment program is geared for students, not just for traditional college-bound or vocational students" (p. 1). Collectively they measure important skills and knowledge in a coordinated and integrated fashion. Far West Laboratory people believe that these measures taken together, present a picture of a high school graduate that truly represents a record of accomplishment that can be presented to a post-secondary institution or an employer.

**Career-technical assessment project (C-TAP)**

The Career-Technical Assessment Project (C-TAP), sometimes referred to as the California Career-Vocational Education Student Certification Project, is an assessment and certification system developed for the California Department of Education by Far West Laboratory. C-TAP's teacher guidebook (1992) clarified the rationale for C-TAP:

The term "career-technical" is used in place of "vocational" to underscore the relevance of this assessment system for all students, not only for "traditional" vocational education students. Because students...
should eventually become part of the work force, all can benefit from this system. (p. 1)

The intended purpose of C-TAP is to develop a student certification system for career-technical education programs offered in California high schools, regional occupational centers and adult education programs. Recently, field-tested C-TAP programs proved to be both rigorous and equitable. Certification is to be awarded to students who have mastered the model curriculum performance standards in their career-technical area of interest. It is believed that certification will increase students access to employment and post-secondary education opportunities.

To be certified, students must successfully complete two general categories of assessment tasks; cumulative and administered. This ensures that students develop the ability to plan, execute and evaluate a project over a course of time as well as perform a particular task as required at a given time.

The cumulative assessment components include:

1. a supervised practical experience;
2. an assessment project; and
3. a structured portfolio.

The administered assessments include:

1. an oral presentation of the project;
2. a written scenario; and
3. a written test of the career performance standards.

It should be noted that this evaluation system divides certification assessment into two major categories; cumulative assessments that occur throughout the program,
and administered assessments that occur upon completion of the program.

**Multiple instrument testing**

Testing and assessment are at a crossroad. Politicians at all levels resort to testing to evaluate the health of the nation's schools. Educators at all levels, stung by recent public criticism, are willing to be held accountable but not by tests unless they have a direct reflection on student learning.

"This is a critical moment in the history of assessment," remarked Stiggins (1993). "The education community must educate its members in the use and misuse of assessment. Educators must demand assessments that meet real instructional needs first and give accountability second."

The word "assessment" has been in the educational arena for many years but only as a synonym for "testing". As norm-referenced tests began to lose favor in the late 1980's, "assessment" was redefined to include other methods than "testing." Today "educational assessment" means a systematic way of gathering and summarizing evidence about student competencies. It includes, but is not limited to, familiar standardized tests in which large numbers of students answer the same kinds of prespecified questions under the same conditions. Also included are activities such as performance, products and portfolios. These latter kinds of assessments require concentrated effort over an extended period of time on challenges determined to a large degree by the student. Mislevy (1992) stated, "Assessments provide data . . .

This data becomes evidence, however, only with respect to conjectures about student competence [Italic original] (p. 3). Mislevy went further and asserted that the
evidence will require diverse data which will need to be gathered through various assessment techniques. Shavelson and Baxter (1992) strenuously reinforced the utility of multiple assessment by stating, "... a combination of indicators (multiple-choice, performance assessments and others) may be needed to provide and complete picture of achievement" (p. 4).

Jung (1992) indicated that the growing interest in testing and assessment is healthy. Jung recognized that public discussion and debate can lead to a greater public understanding, however, it can also lead to confusion. Therefore, six points were proposed for educational leaders to do to lead to a better understanding of assessment:

1. Communicate regularly and often with communities, including the media, about the tests given, pointing to their strengths and limitations.
2. Let the public know why these tests are given and how the results will be used.
3. Clearly interpret test scores and other assessment results.
4. Demonstrate that the testing program is linked to the efforts of teaching students thinking and reasoning skills.
5. Call attention and explain the new and varied forms of assessment.
6. Point out that too much testing can whittle away time from instruction and learning.

Bott (1987) stated: "The aim of all occupational educators is to provide people with skills, knowledge and attitudes necessary for success on the job" (p. 122). Bott continued that it cannot be known whether the students possess the skills,
knowledge and attitudes until they have been demonstrated in one fashion or another. Bott defined the assessment methods that may be used: paper and pencil tests, performance, portfolios, products and observations. Shavelson and Baxter (1992) referred to this procedure as hands-on assessment. They warned that hands-on assessments are delicate instruments:

They need to be carefully crafted, each requiring a specially developed or adapted scoring method. Shortcuts taken in developing these assessments will likely produce poor measuring devices. If these instruments are used to judge the quality of education in classrooms - and they will be used for that purpose - then teachers will teach to the test. If teachers teach to poorly constructed assessments, these assessments are likely to distort good hands-on science teaching. (p. 5)

When dealing with differing assessment techniques several questions arise. Some concerns regard fairness and equity and the inter and intra-reliability of evaluators. Mislevy (1992) stated that assuring fairness, equity and consistency in applying standards becomes important in high stakes testing applications. Bracey (1990) drew an interesting analogy in regards to reliability. Bracey exclaimed, "If Olympic judges can be trained to judge complex athletic performances reliably, why can’t others be trained to judge academic performance reliably" (p. 405)?

Shavelson and Baxter (1992) clearly stated what they believed the current research shows:

. . . that the political rhetoric calling for immediate reform of national, state and local testing systems far exceeds current technological capability and ignores educational and social consequences. No doubt assessment systems will be changed in the very near future. The politicians will have their day. We suspect that the initial impact will be to change classroom activities and the nature of assessment, possibly embedding assessments in classroom activities. However, without quality instrumentation and extensive staff development, the bottom
Outcome-based education

Most recently, this methodology has been sometimes referred to as outcomes-based learning. Many may not be familiar with the relatively new term "outcome-based education" (OBE). The following definition of outcome-based education has been adopted by the Minnesota State Department of Education (1991):

Education that is outcome-based is a learner-centered, results-oriented system founded on the belief that all individuals can learn. In this system:

1) What is to be learned is clearly identified;
2) Learners' progress is based on demonstrated achievement;
3) Multiple instruction and assessment strategies are available and chosen to meet the needs of each learner;
4) Time and assistance are provided for each learner to reach maximum potential. (p. 23)

Spady (1988), a key advocate and developer of outcome-based education, outlined the core beliefs which undergird this educational concept. For Spady, OBE is a method of "organizing for results, basing what we do instructionally on the outcomes we want to achieve" (p. 9). OBE practitioners start by determining the competencies, knowledge and qualities they want students to be able to demonstrate when they complete school and face the challenges of the adult world. Then with these "exit outcomes" (as they are sometimes known) clearly in mind, they deliberately design curricula and instructional systems with the intent that all students will ultimately be able to demonstrate the outcomes successfully.

According to Spady (1988), OBE is not a program but rather a way of designing, developing, delivering and documenting instruction in terms of its intended
goals.

From my perspective, it (OBE) means having all students learn well, not just the fastest, the brightest, or the most advantaged. Unfortunately, our educational systems, schools, and instructional programs are not organized to achieve or ensure successful results; instead, they are organized primarily for student custody and administrative convenience. (p. 10)

For Spady, OBE means that all students can learn if given the time and support to do so. Success encourages success, and schools both create and control the conditions for success. Education that is outcome-based presumes an instructional design in which learning is the constant and time the variable not the reverse.

Looking at outcome-based education in a broader perspective, Finn (1990) believed that history is going to view the final third of this century as a time when the very meaning of education was recast. Under the old image, education was thought of as a "process and system, effort and intention, investment and hope" (p. 584). To improve education meant to try harder, to engage in more activity, to provide people with more services, and to become more efficient in delivering them. Under the new definition which is "now trying to be born" (p. 584), according to Finn, education is the result achieved, or the learning that takes place when the process has been effective. Only if the process succeeds and learning occurs can we say that education happened. "Absent evidence of such results, there is no education, regardless of how many attempts have been made, resources deployed, or energies expended" (p. 585).

Spady and Marshall (1991) strongly agreed that more, longer and harder must give way to different, smarter and better. "... the new paradigm must be success-
based in philosophy and outcome-based in practice" (p. 67). For vocational/technology the most significant aspect of outcomes-based education is to "involve the concept of culminating demonstration" (p. 67).

Guskey (1992) believed that there are five major obstacles confronting the current improvement efforts, each steeped in tradition.

1. The belief that learning outcomes should be normally distributed.
2. The belief that our purpose in education is to select talent.
3. The belief that tests are assessment devices used only to grade and evaluate students.
4. The belief that curriculum and instruction are ends in themselves.
5. The belief that specifying outcomes reduces teaching to those things most easily tested. (pp. 508-509)

Towers (1992) expressed concerns that OBE is flawed and felt that many states have been ill-advised into mandating OBE. Towers voiced four main concerns about OBE. First was a concern about the time element and how it would affect teachers. Tower stated, "No one, to my knowledge, doubts that OBE will require more time and effort from teachers, many of whom are stretched to their limits now" (p. 93).

The second concern was that OBE is an instrument of business rather than of education. "Advocates of OBE, like business leaders, are interested primarily in one thing: results. My concern is not so much with the result, however, as with the process" (p. 94). On the other hand, Deming (cited in Bonstingl, 1992) stated, "The right time for attention to final outcomes in any production process - including the learning process - is at every step along the way" (p. 66), indicating that process and results are intricately intertwined.
The third concern which Towers defined is that of the effect of the most capable students:

The OBE concept, powered by mastery learning techniques, dictates that slower student be retaught and retested if competency levels are not met within the first, second, third or further tries. Another premise of OBE is that students who meet the minimum competency level on the first try will receive 'enrichment' instruction or projects. In theory, this sounds desirable and equitable. In practice, however, remediation is taking priority over enrichment activities, particularity in terms of time devoted to each. (p. 94)

Towers' final concern was that OBE has become more of a political ploy than the sound educational philosophy it actually should be:

It theory, OBE is a very easily understood concept, and due to its simplicity, most people can grasp it. Further OBE 'pushes the right buttons' in the American citizenry (e.g., all students can succeed, increase self-esteem, fewer dropouts, higher test scores, etc.). (p. 95)

Another major opposition for OBE is what has become known as the religious right. Much of the criticism from the religious right is directed at the non-academic outcomes routinely included when statewide committees identify outcomes. Among these are "personal, family and community living," "appreciating and understanding others" and "global citizenship." The advocates maintain that the outcomes and standards represent an effort to foster racial and cultural harmony. To the opponents, "others" insinuate approval of lifestyles they consider perversions. "Global citizenship" is interpreted as to be paving the way for the Anti-Christ and the end of times as envisioned in the Book of Revelation in the Holy Bible.

The religious right assert that Christian values have been slowly eroded from the schools and are being replaced by secular morals and values. The feeling of this
subculture is that America is in moral decay and the only solution in their eyes is "... they see strict Christian Ideology as the only cure for the moral decline in American society - a decline which is due, they believe, to the 'humanist' teachings of the public schools" (Iowa State Education Association, 1993, p. 6). It must be noted that the word humanist is defined by the religious right as that which is ungodly or a worldly machination, while secular society views a humanist as compassionate, free of racism, sexism, or multicultural biases.

The religious right believe that when Christian morals and values are taken out of public schools they are replaced by other values which will further decline the fabric of American society. When the religious right are told that education is to be the primary focus of the schools rather than values, "They remind us that Germany, one of the most highly educated societies, produced the concentration camp and the human oven" (Kincheloe, 1983, p. 8). That they stress is an educated society which had lost its Christian morals and values and replaced them with humanistic values. It must be taken into consideration that the Christian Right consists of many segments of various religious denominations. In addition, although conveniently called the Christian Right allows for a group label, its adherents express several different viewpoints and, therefore, the Christian Right may in no way be dealt with as a cohesive organization.

As Kincheloe stated, the dominant theme in the battles is the right of parents in a democratic society to control what is taught in their schools, which inherently includes values. As Justice Robert Jackson once wrote (cited in Tussman, 1962)
"... if we are to eliminate everything that is objectionable or inconsistent, we will leave public education in shreds" (p. 255). Kniker (1988) conceptualized the conflicts between the New Christian Right (NCR) and public education (Figure 8).

The SOLO taxonomy

A hybrid model evolved from Great Britain to Australia and then to the Commonwealth. SOLO is an acronym for Structure of the Observed Learning Outcome and is based on the observation that, over a large variety of tasks and particularly school-based tasks, learners display a consistent sequence or learning cycle. Biggs and Collis (1989) claimed that there are five basic levels in the learning cycle that can be distinguished: prestructural, unistructural, multistructural, relational and extended abstract. In the simplest format, it is believed that a question or skill demonstration may be broken down into five different learning levels—prestructural being the lowest mode, the middle three falling within the target mode and extended abstract being the highest level mode.

An example of the SOLO concept would be the problem of a student to determine the line length of a rafter. The first learning mode might be that of using the right function keys on a calculator the simplest format yet achieving the correct answer. The three within the target mode would possibly be the carpenters square step off method, computer software determination and an arithmetical solution. The extended abstract could possibly be the mathematical formula to determine the line length of a rafter.

The Commonwealth Schools Commission Report commended the SOLO
<table>
<thead>
<tr>
<th>Issue</th>
<th>NCR Position</th>
<th>NCR Perception of Public School Teaching</th>
<th>NCR Implication for Public School (NCR Solution)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULTIMATE AUTHORITY</td>
<td>God is architect of all standards</td>
<td>Humans determine standards</td>
<td>Secular humanism in textbooks</td>
</tr>
<tr>
<td>(nature of truth)</td>
<td>(absolute and eternal no errors; one way is best)</td>
<td>(relative; all views are of equal worth)</td>
<td>(Bible reading needed)</td>
</tr>
<tr>
<td>HUMAN NATURE</td>
<td>Sinful; need for guidance/discipline</td>
<td>Basically good; Curiosity encouraged; Questioning of authority promoted</td>
<td>Critical thinking skills</td>
</tr>
<tr>
<td>(natural world)</td>
<td>(special creation)</td>
<td>(evolution is true)</td>
<td>(creation science added)</td>
</tr>
<tr>
<td>SACRED/SECULAR</td>
<td>All of life is religious</td>
<td>Sacred and secular can be separated</td>
<td>School prayer; Moral Relativism</td>
</tr>
<tr>
<td>(neutrality)</td>
<td>Equal access</td>
<td></td>
<td>Equal access</td>
</tr>
<tr>
<td>FREEDOM AND PRIVACY</td>
<td>Individual and parent are first; Privacy is paramount</td>
<td>Group is first; Privacy is secondary</td>
<td>Collectivism; Sex education</td>
</tr>
<tr>
<td>(family role)</td>
<td>(primary teacher)</td>
<td>(child is &quot;creature of state&quot;)</td>
<td>(home schooling; religious schooling)</td>
</tr>
<tr>
<td>TOLERANCE</td>
<td>One country, one religion is best</td>
<td>All nations, religions are equal</td>
<td>Multicultural education; Academic study of religion</td>
</tr>
<tr>
<td>(pluralism)</td>
<td>(America is godly, chosen nation)</td>
<td>(one-worldism)</td>
<td>(no bilingualism; no human relations)</td>
</tr>
<tr>
<td>CONCLUSIONS</td>
<td>Public schools are untrustworthy; if they cannot be reformed, they are to be abandoned.</td>
<td>Public schools promote free thinking, tolerance for all, equal educational opportunity; values anarchy.</td>
<td>Public schools are fully funded government antireligious agencies. (vouchers, tuition tax credits, alternative schools)</td>
</tr>
</tbody>
</table>

Figure 8. Challenges to public education from the New Christian Right (Kniker, 1988, p. 320)
concept as achieving considerable progress towards meeting the problem of comparing performances across students and across subject areas. The problem of determining standards in a way that applies across schools and subject areas is one that has concerned educators, parents, employers and the community generally. One solution, and an increasingly unpopular one today, has been to set standards to a common external examination, however, that creates other problems.

If, however, the internal logic of a topic is used to define "standards," the school is left free to develop its own curricula, and to measure student competence in that topic in terms of that internal logic. The SOLO taxonomy enables teachers to specify levels of competence in particular topics in a framework that are widely generalizable across students, subject areas and grades, which makes it particularly useful in the current debate on school-based assessment.

In conclusion, the literature review has focused on curriculum models and methods that will be incorporated into the development of a curriculum model for vocational/technology education. A brief synopsis of this review is shown in Table 1.

**Related Studies**

Unfortunately, both manual and computer searches for dissertations or other publications in the area of vocational/technology curriculum models or frameworks were fruitless. The most closely related studies were found in the form of two presentations given by Zuga (1992) and Johnson (1992) on curriculum theory in technology education and cognitive science and technology education, respectively. Both of these papers focused on the theoretical aspects of what goes into curriculum
Table 1. Synopsis of the review of literature

<table>
<thead>
<tr>
<th>MODEL/METHOD</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITECO curriculum development model (ICDM)</td>
<td>Framework of the model is divided into six processes for curriculum development: research, development, production, validation, installation, and client.</td>
</tr>
<tr>
<td>Finch &amp; Crunkilton curriculum development model</td>
<td>Curriculum framework consists of three main components: planning and curriculum; establishing curriculum content; and implementing the curriculum.</td>
</tr>
<tr>
<td>Task analysis</td>
<td>The process of delineating the task (job) into the elements required to complete it satisfactorily.</td>
</tr>
<tr>
<td>DACUM approach</td>
<td>Experts employed in a particular occupational area determine the curriculum content.</td>
</tr>
<tr>
<td>Tyler model</td>
<td>Program evaluation is carried out by a three-step model: input, process, and output.</td>
</tr>
<tr>
<td>CIPP model</td>
<td>Based on the proposition that the most important purpose of evaluation is not to prove but to improve; emphasis is on improvement through formative evaluation.</td>
</tr>
<tr>
<td>Darcy’s model</td>
<td>Program improvement is achieved by looking at the process and then rating it by accessing the outcomes.</td>
</tr>
<tr>
<td>Competency based education (CBE)</td>
<td>The premise is that all students will achieve a minimum pre-set level of accomplishment in each skill or knowledge area.</td>
</tr>
<tr>
<td>Subject integration</td>
<td>A technique used to stop curriculum fragmentation. Subjects are blended and combined to reflect the real world.</td>
</tr>
<tr>
<td>Tech prep</td>
<td>A secondary education program to serve employment requirements with the option of articulation to post-secondary programs.</td>
</tr>
<tr>
<td>Total quality management (TQM)</td>
<td>A structured system for meeting and exceeding needs by creating organization-wide participation in the planning and implementation of continuous improvement.</td>
</tr>
<tr>
<td>Authentic assessment</td>
<td>A term for alternative assessments, including evaluation of one or more P’s: portfolio, performance, process, and/or product.</td>
</tr>
<tr>
<td>Psychomotor assessment</td>
<td>Assessment of actual performance of work; used heavily in the vocational/technology area and closely associated with authentic assessment.</td>
</tr>
<tr>
<td>Performance standards</td>
<td>A theory whereby performance standards are established and students who meet the “world class” standards receive a certificate of mastery.</td>
</tr>
</tbody>
</table>
Table 1. (Continued)

<table>
<thead>
<tr>
<th>MODEL/METHOD</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Career-technical assessment</td>
<td>A student certification system (performance standards) for career-technical</td>
</tr>
<tr>
<td>project (C-TAP)</td>
<td>education programs.</td>
</tr>
<tr>
<td>Multiple instrument testing</td>
<td>The proposition that more test samples of different varieties will allow</td>
</tr>
<tr>
<td></td>
<td>for a truer picture of a score.</td>
</tr>
<tr>
<td>Outcome based education (OBE)</td>
<td>Based on the premise that knowledge acquisition is learner centered and</td>
</tr>
<tr>
<td></td>
<td>results oriented, and founded on the belief that all individuals can learn.</td>
</tr>
<tr>
<td>SOLO taxonomy</td>
<td>A concept that enables evaluation of performances across students and</td>
</tr>
<tr>
<td></td>
<td>subject areas.</td>
</tr>
<tr>
<td>School improvement model</td>
<td>A curriculum renewal, alignment, and assessment processes based on the desire</td>
</tr>
<tr>
<td>(SIM II)</td>
<td>to increase student achievement.</td>
</tr>
</tbody>
</table>

Over the past several decades, several attempts have been made to reform the industrial arts (technology) portion of the curriculum. In the 28th yearbook, *Industrial arts education: Retrospect and prospect*, Martin (1979) provided a comprehensive picture of curricular theory and practice in technology education over the two decades ending in 1980. Numerous curriculum projects had had significant impacts on the profession.

The most recent curricular reform was the Jackson’s Mill, Industrial Arts Curriculum Theory document (Snyder & Hales, 1981), one of the most comprehensive documents concerning curricular theory that influenced curricular revision in the 1980s and served as a foundation for technology education curricula late in the decade. This document was prepared by 21 selected curriculum leaders in industrial arts and technology education who had convened to reconcile opinions on
whether industry or technology should be the focus of curricular content. Four major curricular content categories were identified: (a) manufacturing systems; (b) communications systems; (c) construction systems; and (d) transportation systems.

During the boom years of the 1960s and early 1970s, a plethora of curriculum models emerged. Detailed accounts of the different program developments, objectives and structures of curriculum models were written by Cochran (1970) and Martin (1979). The most popular curriculum models developed during that early era are listed in alphabetical order in Table 2.

Curriculum models in vocational/technology education where plentiful mid-century and then dwindled to one trendsetter in the 1980s to virtually no curriculum format in the 1990s. However, one may say that subject integration, tech-prep and other vocational/technology innovations serve as curriculum frameworks.

Summary

The present investigator gained insights from the literature on curriculum theory and development models, curriculum evaluation concepts and educational curriculum and assessment models. An understanding of unique perspectives was gained in reviewing competency based learning (CBL), subject integration, tech prep, total quality management (TQM), authentic assessment, psychomotor aspects of assessments, performance standards, career-tech. assessment project (C-TAP), multi-instrument testing, outcomes based education (OBE), and the SOLO taxonomy (structured observable learner outcomes). The review of literature contributed to a deeper understanding of curriculum theory and practices and to strengthen the
Table 2. Popular curriculum models of the 1960s and 1970s

<table>
<thead>
<tr>
<th>Curriculum Plan</th>
<th>Developing Institution</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Alberta Plan</td>
<td>University of Alberta</td>
<td>The interrelationships among functions, processes and technologies in industry</td>
</tr>
<tr>
<td></td>
<td>Edmonton, Alberta, Canada</td>
<td></td>
</tr>
<tr>
<td>American Industry Project</td>
<td>Stout State University</td>
<td>The study of industrial concepts applied to production and manufacturing themes</td>
</tr>
<tr>
<td></td>
<td>Menomonie, Wisconsin</td>
<td></td>
</tr>
<tr>
<td>The Georgia Plan for Industrial Arts</td>
<td>Georgia Southern College</td>
<td>The teaching of skills and technologies to assist students to adjust to the increasingly complex industrial element that surrounds them</td>
</tr>
<tr>
<td></td>
<td>Statesboro, Georgia</td>
<td></td>
</tr>
<tr>
<td>Industrial Arts Curriculum Project</td>
<td>The Ohio State University</td>
<td>Industry presented in two themes: the world of manufacturing and the world of construction</td>
</tr>
<tr>
<td></td>
<td>Columbus, Ohio</td>
<td></td>
</tr>
<tr>
<td>Industrial Arts: A Study of Industry and Technology</td>
<td>University of Maryland</td>
<td>The study of industry and technology and their contributions to the culture</td>
</tr>
<tr>
<td></td>
<td>College Park, Maryland</td>
<td></td>
</tr>
<tr>
<td>Introduction to Vocations</td>
<td>North Carolina State University</td>
<td>Assisting students toward an ultimate vocation as they move through school</td>
</tr>
<tr>
<td></td>
<td>Raleigh, North Carolina</td>
<td></td>
</tr>
</tbody>
</table>

research design for this study.

Clearly, all curriculum and assessment models may contribute to a derived model. The present investigator attempted to incorporate those aspects of the literature review that would help in constructing the proposed model for vocational/technology.

Competency based learning, although a past phenomena in educational circles, had an impact in providing standards. The competency based standards in vocational/technology then carried over to the performance standards or career-tech
assessment project. Taking into account that standards are continually requested by politicians and others in an effort to make educators accountable, it is this investigator's opinion that standards must be defined in a curriculum model.

Total quality management offers many unique concepts; however, the philosophy of continuous improvement without internal competition between employees or students can be taken into the same arena as criterion reference testing or the measuring of performance, which is essential as a component in the construction of any curriculum model.

Psychomotor assessment is vitally important in measuring what students have learned in the practical arts. Uniquely, psychomotor assessment and authentic assessment can easily be blended together to determine the competencies or standards which students must achieve.

Outcomes based education, currently in vogue, is essentially student centered and certainly fits very well with total quality management. The present investigator views student outcomes (the general desired student qualities) as clusters of competencies (the specific skill and knowledge abilities of a student).

Subject integration (horizontal and vertical) is widely publicized and experimented with in today's educational systems. With Carl Perkins monies in vocational/technology education dependent upon subject integration, it may be safe to say that many efforts will be made to integrate subjects and the derived model was designed in such a fashion as to allow for this.

Multiple instrument testing is a valuable tool to any educator. In the words of
Omotani (1992) "more is better" is unique and should be remembered regardless of what population is being evaluated. Combined with the onset of authentic assessment and the use of tried and tested criterion referenced tests, the curriculum model will encourage the use of multi instrument testing.

Finally, the SOLO taxonomy was utilized to develop the curriculum model, particularly in the evaluation phase of the proposed model. Use of the evaluation concepts in this model provides a means to specify levels of competence that are generalizable across students, subject areas and grades.
CHAPTER III. METHODOLOGY

The purpose of this study was to develop a curriculum model for vocational/technology education. Several models were investigated, however, the School Improvement Model (SIM) was the most pre-eminent in the investigation with its applicability addressed to the vocational/technology field.

Since this study utilizes a combined case study/feasibility methodology, this chapter includes a brief review of literature on qualitative research. Both quantitative and qualitative research approaches can be rigorous, systematic forms of empirical inquiry; however, one way of clearly distinguishing between the two approaches is to use Everhart's (1975) notion of "how?" (qualitative) versus "how well?" (quantitative). Bogdan (1982) called qualitative research the "multiple realities" of a situation-how something is experienced and perceived by others.

Overview of Qualitative Research

A brief review of qualitative research is presented as a rationale for establishing the need to employ an investigative research methodology.

Use of qualitative research in education

It was not until the late 1960s that qualitative research in education began to be used to any great extent. Qualitative research had been associated with other descriptive terms that either described or were used synonymously. Terms such as field research, naturalistic, ethnographic, symbolic interactionist, the Chicago school, phenomenological, case study, interpretive, and descriptive were widely used to define
qualitative research (Bogdan & Biklen, 1982).

Chronological review of literature on qualitative research

A catalyst was given to qualitative research in the 1960s as federal agencies started to fund research employing qualitative methods. By the mid-1960s, the American federal government began to "encourage anthropological research into American schools" (Eddy, 1985, p. 86).

Rist (1984) suggested that qualitative researchers "... change their attitude from 'disdain' to 'detente'" and further stated that the way to "understand human beings and the social environments that they have created is to watch, talk, listen, and participate with them in these environments" (p. 160). Rist concluded that qualitative research focuses on a different way of knowing-one based on experience, empathy and involvement.

Bogdan and Biklen (1982), in a historical review of the traditions of qualitative research within an educational context, noted that:

Qualitative research methods represented the kind of democratic impetus on the rise during the sixties. The climate of the times renewed interest in qualitative methods, created a need for more experienced mentors of this research approach, and opened the way for methodological growth and development. (p. 20)

Characteristics of qualitative research

Several characteristics can be used to describe qualitative research. Borg and Gall (1989), and Rogers (1984) identified several characteristics that qualitative researchers associate with their methodology. These characteristics are best summed
1. Qualitative research has the natural setting as the direct source of data and the researcher is the key instrument.
2. Qualitative research is descriptive.
3. Qualitative researchers are concerned with process rather than simply with outcomes or products.
4. Qualitative researchers tend to analyze their data inductively.
5. "Meaning" is of essential concern to the qualitative approach.

Eisner (1979) defined "meaning" as "learning how one comes to know". Goetz and Le Compte (1984) defined it clearly by stating, "... describing participants, settings, and circumstances so clearly that the image produced constitutes providing a verbal photograph."

**Qualitative research methodology**

Specific qualitative research methodology, as identified by Borg and Gall (1989), includes the following:

1. Holistic inquiry—the study of all elements present in the setting in which the inquiry takes place. The study of all aspects in an effort to understand reality;
2. Humans as data—gathering instruments-by the use of researchers as observers; the rationale is that humans are flexible to adapt to the complex situations as they evolve. It is assumed that the researchers can identify and take into account biases that result from the interactions and value differences between the "instrument" and the subjects;
3. Purposive, rather than random sampling—the purposeful selection of subjects to observe. With the selection of a wide range of subjects it is believed that the
researcher will be more likely to uncover the full array of "multiple realities" relevant to the inquiry;

4. **Inductive data analysis**—instead of focusing on testing preconceived hypotheses. The data is studied inductively in an effort to reveal unanticipated outcomes; the researcher first gathers the data then tries to develop an understanding and draw generalizations;

5. **Development of grounded theory**—the theory that is "grounded" in the research or developed from the data. It is thought that grounded theory will not limit or bias the perceptions of the observer as a priori theory might;

6. **Emergent design**—as the research progresses. The research begins with a tentative design but allows for the adaptation of the design to include variables that were not anticipated prior to the beginning of the observation;

7. **Interpretation of outcomes**—the researcher usually attempts to reconstruct reality from the vantage point of the subjects;

8. **Intuitive insights**—qualitative researchers place an emphasis on the tacit or intuitive knowledge obtained from interactions in the research situation;

9. **Emphasis on social processes**—focus upon social processes and the meanings the participants attribute to the social situations; and

10. **Confirmation interviews**—questionnaires or structured interviews that produce evidence to confirm earlier findings.
Limitations of qualitative research

Borg and Gall (1989) and Rogers (1984) have also identified some shortcomings and limitations of qualitative research:

1. It is possible to limit, but not to eliminate any observer bias;
2. Similar studies can be accomplished, but exact replications are not possible;
3. Observers/interviewers or researchers cannot record everything that they experience; as a result selected segments of reality are studied over long periods of time. This gives the researcher a significant sampling of reality, but never a complete picture;
4. The majority of qualitative research consists of single case studies in limited settings. This situation constantly leaves researchers faced with the problem of relating their "micro" studies to the "macro" culture at large;
5. Qualitative researchers must constantly make subjective choices about their sources of data;
6. It is difficult to do field studies in an educational setting; subjects may behave differently when an outsider is present, thus, obscuring the true behavior.

Action Plan

The study was conducted through three phases: Phase one-preparation of process and material; phase two-data collection and statistics; phase three-reporting the findings.

Phase One: Preparation of process and materials

Step 1 Document analysis/interviews.
1.1 Examine and document the SIM model regarding techniques and approaches.

1.2 Personal and telephone interviews with selected resource persons.

Summary: Personal interviews with D. Manatt and S. Stow. Read all SIM publications and sequenced training materials. Telephone interview with P. Allen.

Step 2 Review the literature.

2.1 List curriculum content determinators in the vocational/technology area.

2.2 Determine how psychomotor aspects are evaluated in other areas and might relate to the vocational/technology area.

2.3 Analyze other curriculum reform concepts.

2.4 Ascertain if curriculum renewal, alignment and evaluation process are valuable for vocational/technology.

Summary: Research literature for curriculum content in the vocational/technology area. Study all three learning domains and determine from the literature how heavily vocational/technology is dependent upon the psychomotor domain. Review literature for other curriculum reform concepts and determine if vocational/technology lends itself to curriculum renewal, alignment and evaluation.

Step 3 Develop model and validation criteria.

3.1 Use the program evaluation standards as a guideline and yardstick for determining utility, feasibility, propriety and accuracy standards (Joint
Committee on Standards for Education Evaluation, in press; Appendix A).

3.2 Develop validation criteria.

**Summary:** Using the 1981 book and the new standards outlines as a guide, the derived model will be measured. Through the review of literature, determine the criteria that the knowledgeable panel will use to assess the derived model.

**Step 4** Validate and modify the model by a knowledgeable panel of practitioners and researchers using a list of criteria developed for this purpose. The panel consisted of five to seven experts having knowledge in both curriculum and vocational/technology education, as agreed upon by the co-chairs of the committee.

**Summary:** Eight practitioners and researchers were selected to participate on the knowledgeable panel, held on June 17, 1993. After viewing the model and listening to a presentation, the panel questioned the present investigator and then responded to the criteria as indicated in the questionnaire.

**Phase Two:** Collect data and run statistics

**Step 1** Collect student data from Monroe county tapes.

a. Grade 11 & 12 Social Studies (government & economics) semester course.

b. Pre-test and post-test results Fall/92 & Spring/93.
Summary: Due to the timing of this project, the only pre-test and post-test results available were from the previous semester course in government and economics from Monroe County, Florida. (See Appendix B for letter of permission to use data.)

Step 2  Analyze data and test the hypothesis using t-tests and ANOVA.

2.1 Hypothesis to be tested:

There will be no significant differences in achievement of students as measured by gain scores whose teachers:

a. had no involvement in the renewal and test development.
b. were involved in curriculum renewal.
c. were involved in the renewal and test development.

Ho: $\mu_1 = \mu_2 = \mu_3$

Ha: $\mu_1 \neq \mu_2 \neq \mu_3$

a. Independent variable, teachers of different curriculum renewal exposures.
b. Dependent variable, student gain scores

2.2 Determine if a significance exists (at the .05 level) between student achievement as measured through gain scores whose teachers:

a. had no involvement in the renewal and test development.
b. were involved in curriculum renewal.
c. were involved in the renewal and test development.

2.3 Analysis and synthesis.
Phase Three: Reporting the findings

Step 1  Summarize the data.

Step 2  Present and interpret the findings.

Step 3  Draft conclusions, recommendations and implications for practice.

Step 4  Write the report.
CHAPTER IV. ANALYSIS AND FINDINGS

The purpose of this study was to determine if and how the School Improvement Model (SIM) for curriculum renewal, alignment and evaluation could be successfully applied to the vocational/technology area. To accomplish this task, the SIM model was examined, the literature was searched for vocational/technology content determinators, the aspect of psychomotor assessment was researched and a knowledgeable panel was asked to validate and modify the model from a list of criteria developed by the present investigator.

This chapter presents the findings according to the phases of the study as outlined in Chapter III. The status of the objectives will be addressed in the relevant phases. Phase one findings will discuss the objectives of the study individually and will include the introduction of the vocational/technology curriculum model and the validation criteria questions asked of the knowledgeable panel. Phase two findings will focus on the results of the hypothesis testing.

Phase One - Findings

Phase one was designed to address objectives one through eight.

The status of the objectives for this research study were:

Objective 1: Review, examine and document the SIM model in each of the four areas with respect to its techniques and approach.

a. Minneapolis district for a long-term analysis.
b. Thermopolis, Wyoming for testing only.
c. Monroe county for the entire SIM package.
d. Arizona SIM for the multi-district approach.
School improvement model II (SIM II)

The school improvement model is known for its total-systems approach to improving classroom performance, schools, and entire school organizations. The beginnings of the performance appraisal research had meager beginnings but by 1977-78 the organization had become well established. Throughout this entire study, numerous interviews were held with D. Manatt and S. Stow (Co-directors of SIM) to establish practices, procedures, and process clarification. The interviews and review of the SIM files made this research possibility become a reality.

Minneapolis district study The original SIM project began with a chance discussion between Drs. Richard Manatt, formerly a performance appraisal researcher, and Ralph Lieber, formerly a superintendent of the Edina, Minnesota Public Schools. Lieber suggested that a huge experiment be attempted with several school districts to improve instruction and provide an accountability model.

The SIM project was designed to demonstrate the effect of an articulated system of teacher and administrator performance appraisal with intervention to encourage productive instructional behaviors. This was dependent upon student achievement in mathematics and reading at the elementary along with mathematics at the secondary school levels. This was measured by both norm-referenced and criterion-referenced tests. Manatt (1993a) wrote:

Such a model for measuring and improving educational outcomes had not been attempted before. Indeed, such a project would be a landmark contribution to public and private education and holds great promise to set educational policy for many years to come. (p. 17)
The four-year project was proposed by R. Manatt and J. S. Ahmann of RISE and was focused around a consortium of five school organizations, viz., the Minneapolis Public Schools, Edina Public Schools, Northfield Public Schools, Breck School (private) and the Spirit Lake (Iowa) Public Schools. Shortly after the project's inception, Dr. Shirley Stow joined Dr. Manatt as co-director of SIM.

The consortium project involved millions of dollars representing wages, direct operating costs and related expenses. Each of the consortium school organizations was selected to represent particular types of educational cultures. Each was treated as a separate research entity, and all the project reports reflected that decision. Minneapolis was the largest of the school organizations and offered the special problems and advantages of a large and dynamic school district. Minneapolis had a big city flavor with many minority students, a rich and varied program of educational offerings. This was combined with a special challenge of having to cut back its numbers of attendance centers and personnel to match a steep decline in enrollments. During year three of the four-year project, Minneapolis closed 19 buildings which had a major impact on the entire research design.

Edina Public Schools, adjacent to Minneapolis, was selected—in part—to represent a successful suburban district with mostly upper and middle class students. Edina was the type of district which wins repeated national recognition for excellence in educational programming. This school was not seeking mere competence, but instead, aspired to pre-eminence.

Northfield Public School District is located approximately 40 minutes south of
Minneapolis via number 35 interstate highway. Northfield is a college town (Carlton and St. Olaf), but was reported as interesting because of its well-established model of school learning based upon the UCLA teacher decision-making model, typically associated with Dr. Madeline Hunter.

Spirit Lake Community Schools in Iowa was representative of small rural school districts so typical nation wide. However, Spirit Lake was also atypical because of the effective Management by Objectives (MBO) approach used by the board and administration to govern the district.

Last, but not least, Breck School was selected to represent the many independent and/or parochial schools in the United States. Breck, affiliated with the Episcopal Church, is a pre-kindergarten through twelfth grade day school. At the beginning of the project, Breck was located near downtown Minneapolis. In the final years, Breck moved to a new campus in Golden Valley (Minnesota) just west of Minneapolis.

The administrator and teacher performance evaluation systems were developed first. This was followed by strategies to improve professional performance (Job Improvement Targets). Next, the student achievement testing was developed, incorporating both norm-referenced and criterion-referenced testing executed in the spring and fall of each year. After the testing program came staff development, climate assessment, and cost analysis, respectively. Finally, path analysis and analysis of variance statistical procedures were utilized to determine the effects of entry-level knowledge and skills, attendance, gender, race and socio-economic status (SES) of
the students on student achievement (Manatt & Stow, 1986).

To use the words of Manatt (1993a), the "... quality of the educational program was operationally defined in terms of student achievement" (p. 20). In other words, teachers and administrators were to be taught how to do their jobs better and coached for improved performance via appraisers using state-of-the-art appraisal tools and skills. Student learner outcomes would be examined for improvement, or determine if any improvements existed.

The following conclusions were reported in the Manatt and Daniels (1990) document. The paramount finding was that principals could accurately evaluate the performance of teachers when principals were given extensive training and when the limitations of earlier studies regarding instrumentation and methodology are overcome. Thus, principals are a good judge of teacher performance. Other findings included:

1. Teacher and student attendance had a considerable impact on student achievement.

2. Measuring school climate afforded teachers the prime opportunity to give principals feedback.

3. The significant effect of the total-systems approach of pre- and post-testing (with appropriate reports to teachers) on student achievement.

4. The cost of performance appraisal for teacher performance ranged from $116 to $242 and the twice per year test cost $5 per pupil per year.

The total-systems approach to improving classroom performance, schools, and entire
school organizations came to be known as the School Improvement Model (SIM).

When the Manatt/Daniels research based on the original SIM was completed, Manatt shared the realization in a June 28, 1993, interview that the powerful part of the study was the criterion-referenced testing. This was the birth of SIM II. Thus, the long range important finding of the original SIM model was that instruction could be improved as much by conducting criterion-referencing pre- and post-tests as by infusing $100,000.00 into staff development.

There were three treatment groups: (a) observation or pretest, treatment ($100,000.00 worth of M. Hunter), and post-test; (b) observation or pre-test, no treatment, and post-test; and (c) no pre-test, no treatment, but post-test only. The pre- and post-test groups demonstrated significant achievement over all other groups. Therefore, curriculum alignment and pre- and post-testing proved to be the answer, and thus, the beginning of SIM II. SIM II dealt soley with curriculum assessment, not appraisal performance of educators.

**Thermopolis, Wyoming study** The "Nation at Risk" report and subsequent state-level mandates intended to raise achievement, found SIM in high demand from 1985-90. The first opportunity to test the SIM II model came from a three-district consortium, originally Pindale, Jackson and Thermopolis, Wyoming. Thermopolis (Hot Springs County School District #1) requested a curriculum alignment and assessment project with the intent of linking student achievement to teacher compensation. The main emphasis was the development of criterion-referenced measures.
The foundation upon which the curriculum development project was to be constructed, was based on what came to be known as the Tyler rationale (Tyler, 1949):

1. What educational purposes should the school seek to attain?
2. What educational experiences can be provided that are likely to attain these purposes?
3. How can learning experiences be organized for effective instruction?
4. How can we determine whether these purposes are being attained? (p. 1)

There was a strong belief within the district that the people most qualified and most appropriate to answer the aforementioned questions were classroom teachers. There was a commitment that whatever was developed needed to be teacher-based and specific to the needs of students and staff in Hot Springs County. This involvement would later provide the commitment and ownership that was essential to support the successful implementation of the curriculum.

In order to address the Tyler rationale questions, subject area K-12 curriculum committees were formed. A six part framework for developing curriculum was adopted: a) philosophy statement; b) strands of learning; c) program goals; d) instructional objectives; e) instructional activities (students’ and teachers’); and f) criterion-referenced measures. Of paramount importance in this project was the notion of curriculum alignment, that is, the congruent relationship of the written, taught, and tested curriculum, the main question being: Does each one support the other two (Manatt & Holzman, 1991)?

The School Improvement Model was highly successful in reaching the prime
objective of raising student achievement district-wide as measured by the composite results of the SRA achievement tests. Achievement increased 20 percentage points in grades K-5, and 16 percentage points in grades K-12. These gains persisted over five years (Manatt, 1992-93). Equally important were the affirmative results of the formative measures of teacher and administrator performance evaluations, student and parent feedback, and the school climate measures.

The district desired improved student achievement but not at the cost of low teacher morale, dissatisfied parents, and exploited students. Because of continuous climate measures, student feedback to teachers, and parent feedback, the District could be certain that the achievement gains were an unmixed blessing. Manatt (1993a) reassured, "... the improvement curve continued for five years; it was not simply Hawthorne affect" (p. 36).

**Monroe County, Florida** The entire SIM II package was delivered to the Monroe County system. SIM had the advantage of following the CIPP plan which was introduced to the Florida Department of Education earlier. Authentic assessment was added by the SIM team to the criterion-referenced tests to assist in measuring student achievement. The umbrella term for the combination of authentic assessment and criterion-referenced tests was "criterion-referenced measures."

Criterion-referenced measures of student mastery provide information on pupil achievement. This achievement is relative to a set of instructional objectives/skills identified as an essential part of the curriculum. Tests items are precisely designed to determine whether a student achieves a specific criterion. The results are typically
recorded in percentile scores of students attaining an objective or set of objectives.

Criterion-referenced measuring is a vehicle for making inferences about how much students know at one or more points in time. Manatt (1993b) contended that in order to make such inferences, the following must take place:

1. a clearly defined core curriculum consisting of essential skills and concepts,
2. specific objectives corresponding to the skills/concepts in the core curriculum,
3. a representative sample of student performance for each objective, and
4. a standard of proficiency for each objective.

Manatt continued by stating the following procedures are required for the development and implementation of criterion-referenced measures.

1. Identify strands of learning for each subject.
2. Create sequence and scope chart of learner outcomes (K-12).
3. Divide a course or program into units of instruction.
4. Establish one goal statement for each unit.
5. Develop one or more terminal objectives (exit skills) for each unit.
6. Construct item specifications for each objective.
7. Generate a bank of test items for each set of item specifications.
8. Edit items and field-test one-on-one (optional) and group field-testing (necessary).
9. Conduct item analysis. Shelve (revise at later time) or discard faulty items.
10. Assign items to parallel test forms.
11. Administer tests.
12. Analyze and interpret test results.

13. Recycle instructional goals, objectives, and test items as appropriate.

Typically, in Year One SIM develops curriculum and tests for mathematics, language arts and reading; social studies and science in Year Two; and the final and practical arts in the third year.

Arizona SIM The Arizona SIM is a combination of four school organizations: Apache Junction, Cave Creek, Coolidge and Maracopa County. This consortium of school districts became a real challenge because SIM has historically focused on one school district at a time, working through their curriculum to enhance student achievement.

The four Arizona districts recognized the need to improve student learner outcomes through aligning the written, taught and assessed curriculum. The common goal of these four districts was to raise student achievement in grades K-12. Cave Creek Unified School District is located north of Scottsdale and has 1,453 students and 102 full time professional staff. Coolidge is southeast of the metropolitan area and serves 2,656 students with a professional staff of 235. The Maricopa County Accommodation Schools are a special type of intermediate unit which is unique to Arizona. The schools serve an air force base, Indian schools, alternative school and a homeless population, with a total student population of 1200 and 125 professionals.

The consortium asked SIM to assist them in developing a holistically-aligned curriculum K-12 in Language Arts, Mathematics, Reading, Social Studies, Sciences, Fine Arts and Practical Arts. The initial priority was given to Math, Reading and
Language Arts guides. The SIM team will also assist the consortium in the development of criterion-referenced measures.

Objective 2: Determine how SIM works in:

a. Identifying what the district is doing.
b. Renewal in the district curriculum.
c. Alignment of the curriculum within the district.
d. Scope and sequence development.
e. Pilot testing the courses.
f. Orientation of all teachers.

The school improvement model systems approach

The school improvement model has delineated responsibilities between the school district and themselves with time allotments clearly indicated (Figure 9). Within each step of SIM, handouts (sequenced training materials) and assistance are provided by the consultants for the district curriculum committee members. The goal for the SIM team and the school district is to raise student achievement. The method the SIM team utilizes to raise student achievement is through the renewed, aligned and assessed curriculum.

Manatt (1989) stated, "The heart of the School Improvement Model is the planning and direction from the stakeholders' committee" (p. 4). The stakeholders' committee is comprised of school district representatives including teachers, administrators, board members, parents and, at times, students. It is through the stakeholders' committee that the subject committees are established. Wilson and Stow (1990), proclaim that all schools have curriculum, most of the time its development is the responsibility of virtually everyone as a result no one takes
**SCHOOL IMPROVEMENT MODEL - IOWA STATE UNIVERSITY**

<table>
<thead>
<tr>
<th>SIM Responsibility</th>
<th>Time Allotments*</th>
<th>Client District Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On Campus</td>
<td>In District</td>
</tr>
<tr>
<td>A typical district will do 40 subjects in three years. A subject such as math will have one test for each level K-12.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Review research and academic societies' guidelines.</td>
<td>10 PD</td>
<td></td>
</tr>
<tr>
<td>2. Secure samples of curriculum plans and outcomes: a) search</td>
<td>3 PD</td>
<td></td>
</tr>
<tr>
<td>b) duplicate/prepare</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>3. Prepare instructional modules for training curriculum developers: a) create &amp; illustrate</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>b) assemble &amp; ship</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>4. Serve as consultants to provide training and prepare results of sessions.</td>
<td>25 PD</td>
<td>13 PD</td>
</tr>
<tr>
<td>5. Prepare 1st draft curr. guides: a) type</td>
<td>5 PD</td>
<td></td>
</tr>
<tr>
<td>b) edit</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>c) proofread &amp; code</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>d) assemble &amp; sort</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>6. Revise curriculum guide: a) re-edit</td>
<td>5 PD</td>
<td></td>
</tr>
<tr>
<td>b) proofread</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>c) duplicate</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>d) assemble &amp; ship</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>7. Train test developers: a) instructional modules</td>
<td>2 PD</td>
<td>2 PD</td>
</tr>
<tr>
<td>b) duplicate &amp; assemble</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

*District provides work space for all sessions
*Makes time available for teachers

Figure 9. School improvement model (SIM)
<table>
<thead>
<tr>
<th>SIM Responsibility</th>
<th>Time Allocations*</th>
<th>Client District Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On Campus</td>
<td>In District</td>
</tr>
<tr>
<td>8. Prepare 1st draft of curr. guides:</td>
<td>10 PD</td>
<td></td>
</tr>
<tr>
<td>a) type</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>b) edit</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>c) proofread &amp; code</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>9. Serve as consultants to revise tests.</td>
<td>2 PD</td>
<td></td>
</tr>
<tr>
<td>10. Revise tests:</td>
<td>4 PD</td>
<td></td>
</tr>
<tr>
<td>a) re-edit</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>b) proofread</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>c) duplicate, assemble &amp; ship</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>11. Serve as consultants to test developers.</td>
<td>2 PD</td>
<td>2 PD</td>
</tr>
<tr>
<td>12. Conduct pilot test:</td>
<td>6 PD</td>
<td></td>
</tr>
<tr>
<td>a) test booklets prepared</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>b) answer sheets batched</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>c) instructions prepared</td>
<td>2 PD</td>
<td></td>
</tr>
<tr>
<td>d) tests shipped to sites</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>e) score tests, clean scanforms, &amp; batch</td>
<td>2 PD</td>
<td>200</td>
</tr>
<tr>
<td>13. Confer with test developers for critique and refining of tests.</td>
<td>1 PD</td>
<td>1 PD</td>
</tr>
<tr>
<td>a) teach them to use item analysis</td>
<td>1 PD</td>
<td>1 PD</td>
</tr>
<tr>
<td>b) obtain changes needed</td>
<td>1 PD</td>
<td></td>
</tr>
<tr>
<td>14. Revise crit-ref. meas. booklets (Fall testing)</td>
<td>4 PD</td>
<td></td>
</tr>
<tr>
<td>a) type</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>b) edit</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>c) proofread &amp; recode</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>d) dupl. master cc. &amp; disks; ship</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>15. Advise &amp; prepare district personnel to operate pre- &amp; post-tests in future years.</td>
<td>2 PD</td>
<td>2 PD</td>
</tr>
<tr>
<td>16. Provide prog. rpts. to board ed. &amp; curr. councils as needed.</td>
<td>2 PD</td>
<td>2 PD</td>
</tr>
</tbody>
</table>

PD = Professional Day  
hours = time spent by secretaries, artists, research associates

Figure 9. (Continued)
responsibility. The stakeholders' committee takes the responsibility of establishing subject committees.

During the curriculum development process, the K-12 subject committee(s) have time allocated to them to meet and discuss and arrive at a consensus about the curriculum being studied. These meetings (1) eliminate the "bubble up" approach (when curriculum content is developed independently of any discussion with others), (2) avoid gaps, (3) eliminate duplication, (4) tie learning to testing, (5) enhance communication, and (6) ensure alignment through a scope and sequence grid.

The next responsibility of the subject committees is to review the state-of-the-art research. The committee with assistance from the SIM consultants locates and reviews the research, practices and technologies in the curricular area. Elements that could be incorporated into the curriculum are identified by the committee. The committee then reviews the instructional materials currently being used and defines the strengths and weaknesses within them. The existing materials are then compared to what the committee found in the research and this will help to determine additions, deletions or revisions to the curriculum. At this point the committee has one of two alternatives, to recommend to the school board, keeping the existing curriculum or to revise the curriculum.

If the school board decision is to revise (curriculum renewal), a curriculum development framework must be defined and each component developed (Figure 10). These components can be defined as follows:

1. *Philosophy Statement*—beliefs about a curricular area (Figure 11).
Philosophy (Subject Area)

Strands

Program Goals

Scope and Sequence (Articulation format)

Unit Plans
- Learner Outcomes
- Evaluation Activities
- Suggested Activities
- Instructional Tools

Figure 10. Curriculum development framework
Philosophy of Reading

The ultimate purpose of the reading/literature curriculum is to produce individuals who read widely, read well, and make reading a life-long pursuit. Reading begins with students' earliest exposure to texts and written language and progresses to levels of literacy far beyond basic competencies.

Reading is a complex process. Mastering parts of the process must not become an end in itself, but a means to an end. The teaching of any subject area and students' ability to read the language of the content area are fused. A proper balance between teaching specific skills and practicing the whole act of reading must exist.

Reading a wide variety of literature will enable students of all ages to discover a great deal about themselves and the human condition. This would allow the students to broaden insight and vicariously experience places, events, and people that would otherwise not be available to them.

Figure 11. Philosophy statement
2. **Strands**—themes within a curricular area (Figure 12).

3. **Program Goals**—statements (typically two or three per strand) which express the general intent and serve as a "guiding star" toward which to work (Figure 13).

4. **Scope and Sequence Grid**—a listing of skills/concepts/ understandings placed on a format which displays the articulation of them (Figure 14).

5. **Unit Plans**—a sequential arrangement of major concepts and sub-concepts (Figure 15).
   a) **Learner Outcomes** - specific, measurable behavior statements indicating what The Learner Will (TLW) be able to do after the lessons have been taught.
   b) **Suggested Activities** - the exercises the teacher uses to put the learners in touch with the content being taught and what the learner will do to practice the learning.
   c) **Instructional Tools** - ideas to utilize when teaching the lesson.
   d) **Evaluation Activities** - types of assessment measure student learning.

After these tasks have been completed for a curricular area, the committee is ready to select the instructional materials which will be used. The completed framework and the instructional materials are then presented to the school board for adoption.

Prior to the implementation of the Board-adopted curriculum the curriculum must be reviewed, revised and staff development must occur. The teachers who will be implementing the content of the curriculum resource guide need to have
Definition of Reading STRANDS

1. The **Comprehension** strand involves the development of literal and inferential thinking skills as the student relates the printed word to personal experience and understanding.

2. The **Decoding** strand develops the ability to recognize words through use of sound/symbol relationships, word structures, and context clues.

3. The **Language Development** strand involves the development of oral communication (speaking and listening), written communication, and interpretation of the printed words.

4. The **Literature** strand promotes experiences with a variety of literary forms.

5. The **Study Skills** strand promotes the systematic development of the ability to acquire knowledge and information through skills in locating, classifying, organizing, interpreting, and evaluating.

6. The **Vocabulary** strand involves the study of word meanings, applications, and origins.

Figure 12. Strands
# READING

**Program Goals**

<table>
<thead>
<tr>
<th>Strand:</th>
<th>Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Program Goals:</strong></td>
<td>(1) To develop literal thinking skills</td>
</tr>
<tr>
<td></td>
<td>(2) To develop inferential thinking skills</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand:</th>
<th>Decoding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Program Goals:</strong></td>
<td>(1) To demonstrate understanding of sound/symbol relationships</td>
</tr>
<tr>
<td></td>
<td>(2) To demonstrate understanding of word structure</td>
</tr>
</tbody>
</table>

Figure 13. Program goals
SCENE & SEQUENCE: Communication Arts
LISTENING:
Active Listening 1.0

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Develop active listening skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1.1.1 Give attention to speaker; maintain eye contact</td>
<td>x</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>x</td>
<td>1.1.2 Engage only in listening; filter out unrelated distractions</td>
<td>x</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.1.3 Listen while waiting for a turn to speak; allow speaker to finish</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.2 Develop appreciative listening skills (pleasure/enjoyment)</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.3 Develop discriminate listening skills (auditory discrimination)</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.4 Develop comprehensive listening skills (understanding meaning)</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.5 Develop critical listening skills (evaluative/judgmental)</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.6 Develop empathetic listening skills (understanding' response elicited)</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.7 Respond to listening experiences</td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.1 Identify the intent of the speaker/speech</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.2 Recognize speaker cues to main points</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.3 Relate a story or message after listening to it</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.4 Follow a given series of commands appropriate to grade level</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.5 Respond verbally to what has been heard</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.6 Non-verbally respond to what has been heard</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.7 Demonstrate ability to take notes while listening</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.8 Demonstrate ability to recognize details from main ideas while listening</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.9 Demonstrate ability to identify logical fallacies while listening</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.10 Draw inferences from what has been said</td>
<td>x</td>
<td>D</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>1.7.11 Draw inferences from what has been said</td>
<td>x</td>
<td>D</td>
</tr>
</tbody>
</table>

Figure 14. Scope and sequence grid
## UNIT PLAN

<table>
<thead>
<tr>
<th>Course/Grade level:</th>
<th>Reading/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strand:</td>
<td>Study Skills</td>
</tr>
<tr>
<td>Goal:</td>
<td>To develop the ability to locate information</td>
</tr>
<tr>
<td>Skill:</td>
<td>Parts of a Book</td>
</tr>
<tr>
<td>Level:</td>
<td>E</td>
</tr>
<tr>
<td>Learner Outcomes:</td>
<td>After instruction the learner will (TLW) be able to locate and use the parts of a book.</td>
</tr>
</tbody>
</table>

### Teacher Activities:
- Question-and-Answer
  (questions about parts of a book.)
- Form groups to develop book parts.
- Instruct whole group about parts of a book.

### Student Activities:
- After reviewing parts of a book ask students to listen as you read a question. TLW tells where in the book the question could be answered.
- Locate parts of a book in other books than the basal reader.
- After a class story is written, assign groups to develop individual book parts for the story. Compile all parts into a class-created book.

### Instructional Tools (Resources):
- Health TE-3-1: 155, 248, 441; WB: 44, 72; SP-3-1: 52, 58, 76, 90;

### Evaluation:
Record daily assignment, assess the exercises; administer unit tests; evaluate student writing or assign one grade for mechanics and one for content; evaluate writing of peers by using specified criteria; use small group discussions.

---

Figure 15. Unit plan
information provided to them about how to use it as a planning tool for day-to-day lessons. These same instructors also need to become acquainted with the newly selected instructional materials.

A sub-group from within the subject area committee is employed to write test items. For ease of clarification this group is identified as the test writers committee. Before the test writing begins the test developers are trained by the consultants utilizing the appropriate sequenced training materials. The test items constructed are criterion-referenced and it is the duty of the test writers committee to write, revise, rewrite and reselect test items. A number of test items are provided by the consultants, however, since the curriculum is locally written each situation differs and the test writers will choose to reselect some test items from the bank, revise other test items and write the remainder of the required test items to suit the curriculum. The first draft of the test items is then prepared (e.g., the test items are typed, edited, proofread and coded).

The consultants then revisit the district and work with the test writers to revise some of the test items. After the revision has taken place the consultants and their associates re-edit, proofread, duplicate, assemble and ship the tests. The tests would now be piloted with a student group that is representative of the population. Wilson and Stow (1990) indicated that it is important that nothing that is going to be part of the finished test product should be omitted from the pilot test. Once the tests have been piloted the results are critiqued and checked for tests not completed, items skipped, items that are guessed at and an item discrimination statistical check. The
SIM consultants then confer with the test developers and teach them how to use the item analysis and obtain the changes needed.

Tests are re-typed, edited, proofread, coded, duplicated (hard and soft copies) and shipped to the district. The criterion-referenced measures booklets are then ready for Fall pre-testing. Test item format includes: subject/grade level, strand, program goal, skill number, domain level (Bloom's), level of learning (I, E, M, R) and concept/skill fusion will be included when appropriate. The consultants then advise and prepare district personnel to operate pre and post-tests in subsequent years.

It is important to note that, when the curriculum is complete, the SIM team provides the district with a hard copy of the curriculum as well as a soft copy (disk). All the materials provided for the school districts are professionally illustrated.

Objective 3: Develop a list of curriculum content determination factors in the vocational/technology area based on a review of literature.

Curriculum content determination factors

Within the context of SIM, Wilson and Stow (1990) recommended that the committee is to review the state-of-the-art research, looking at practices, technologies and research in the curricular area. In an interview, Manatt portrayed the Gap concept and how it is established with the school district during the first five days of collaboration with the SIM team.

The first step is to record what the district is currently doing in each curricular area. The second step is to establish what the state-of-the-art is in each curriculum
field. The third step is to determine the essential competencies required of students in the particular region/state. During the fourth step, a comparison is made between the present practices within the district using its norm-referenced tests. Finally, the fifth step is to become familiar with the state's authentic assessment requirements (e.g., Arizona's School Assessment Project—ASAP).

The gap is calculated as the difference between the district's current practices compared against the remaining steps (e.g., current practices vs. state-of-the-art; current practices vs. the state's essential skills; current practices vs. the district's norm-referenced tests; and current practices vs. authentic assessment requirements).

The objective, according to Manatt, is to align practices within the district with the requirement of the other steps. Then learner outcomes are built to match each step, and test items are written to measure each learner outcome. This eliminates any potential gaps. Thus, if all steps are properly carried out, the result is an increase in student achievement.

In the vocational/technology area, changes in curriculum should be based on several sources of information. There are a number of excellent sources for developing curriculum (Homer, 1985; Walter, 1988). Homer recommended that the following sources be thoroughly investigated to determine curriculum content:

1. Advisory committee recommendations.
2. A review of the current literature, including journal articles, school college catalogs, and state curriculum guides.
3. Local research reports.
4. Professional association certification requirements.
5. Skill inventories.
6. Faculty recommendations.
7. Articulation agreements.
8. Program evaluation reports (p. 17).

A brief discussion of these information sources will illustrate how these sources can be used to build a quality vocational/technology curriculum:

1. Advisory committee recommendations should be used to point the way, by identifying where a program should change and direct the future course of the program.

2. The review of literature is an ongoing process. For a vocational/technology educator the review is two-fold, to determine the most recent developments in the field as well as ascertain the research advances in the teaching field. Homer (1985) stated that the reviewing of catalogs and curriculum materials from other institutions allows for comparisons of course offerings and upgrading as necessary.

3. Research reports may be attained from local universities, colleges, job services, tax foundations, bureaus of economic research, productivity centers or other schools. Homer (1985) maintained that while it is important to be aware of national developments and trends, it is even more essential that the educator be aware of developments in the community in which the program serves.

4. Professional association certification requirements clearly specify those skills which are needed for students to become certified in the profession. Those certification requirements could be the basis of a skills inventory.

5. Skill inventories may be developed in several ways. One way is the use of Task Analysis, another widely known method is the DACUM system discussed earlier.
Homer suggested that educators should not participate in the DACUM method to remove any educational bias in developing a list of skills.

6. Once the future of the program is planned, faculty recommendations are needed to identify the "How to Teach" component of the system. Homer contended that a team of faculty members can respond to the advisory committee recommendations by designing the course content which most effectively matches the changes needed to build a quality program.

7. Articulation of curriculum is needed within an institution, among schools at the same level, between high schools, vocational technical institutes, two-year colleges and four year colleges. With the intent being to provide students with quality education that is effective and efficient, waste and duplication of effort must be removed from programs.

8. Program evaluation reports are to be drawn from several sources. It is suggested that student evaluations be used together with senior management evaluations and outside assessments. Holmes stated that, "By accumulating evaluation data, we can obtain information that will help us build a curriculum with staying power" (p. 19).

Objective 4: Analyze how the psychomotor aspects of physical education are evaluated in the SIM and related models and determine if it is appropriate for the vocational/technology area.

Stow (1993), the co-director of the SIM office, stated that the psychomotor aspects for physical education were not as advanced as had been anticipated; therefore, very little useful information was available at this time. However, a
literature search found that manipulative tests are one means of assessing student acquisition of specific skills. Students are tested under controlled conditions to evaluate performance related to speed or rate of work, quality or precision of work, and procedure compared with predetermined standards. Biggs and Collis (1989) clearly stated that the practical arts, physical education, and others require the learning of sensori-motor skills. Sensori-motor skills performance can be assessed by close observation and interpretation of the student's execution of processes, procedures, techniques, and products.

**Objective 5:** From the review of literature assess if other curriculum reform concepts could assist in the transformation process.

The review of literature brought forth several curriculum reform concepts which appear to be either very segmented such as curriculum auditing, or so global as the Western Hills Area Education Conceptual Model (Appendix C) that it was difficult to ascertain what role curriculum actually played. Curriculum developmental models were presented in the literature (ITECO; Finch & Crunkilton) together with methods of establishing curriculum content (Task Analysis; DACUM). There were many different curriculum models in the literature; however, the current trend is to follow the universal systems approach or the Tyler model of input, process, output with a feedback loop. Within the systems approach of curriculum development, the recent focus has been on outcomes. Therefore, the current investigator focused on the SIM approach and delineated the strengths and shortcomings in regards to its applicability to the vocational/technology area.
Objective 6: Ascertain if the renewal, alignment, and evaluation processes of SIM are appropriate for the vocational/technology area.

Not unlike any other subject within a school's curriculum renewal, alignment and evaluation in the vocational/technology area can be difficult. However, renewal, alignment and evaluation are still possible with the proper modifications applied to the SIM model. Renewal of curriculum will require additional curriculum content determinators. Alignment of the curriculum remains the same; however, the evaluation portion of the curriculum will require the inclusion of authentic measures in an effort to assess the essential sensori-motor skills developed in the vocational technology area for each particular level of instruction.

From the review of literature and the affirmation by the knowledgeable panel, it was perceived that the vocational/technology area was adaptable to the curriculum renewal, alignment and evaluation methodology used by SIM, however, with several modifications as identified in the derived model.

Objective 7: Develop model and identify criteria for validation using a knowledgeable panel of researchers and practitioners.

The technology/vocational school improvement model (TVSIM)

As with any aspect of teaching or learning, the curriculum aspect must be grounded in the theories of learning. Therefore, a series of theories were investigated prior to the development of the model. The theories which were reviewed and which impacted this model are displayed in Figure 16.

The School Improvement Model (SIM) is a logical sequential approach for curriculum renewal, alignment and assessment. SIM is aligned to each of the
<table>
<thead>
<tr>
<th>Theorist</th>
<th>Theory</th>
<th>Area of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Thorndike</td>
<td>Teaching and learning</td>
<td>Scope and sequence grid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unit plans**</td>
</tr>
<tr>
<td>2. Skinner</td>
<td>Behavior</td>
<td>Curriculum content determinators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Authentic measurements</td>
</tr>
<tr>
<td>3. Hull</td>
<td>Logical deductive</td>
<td>Philosophy statement</td>
</tr>
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<td></td>
<td>Motivational</td>
<td>Curriculum content determinators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scope and sequence grid</td>
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<tr>
<td></td>
<td></td>
<td>Unit plans*</td>
</tr>
<tr>
<td>4. Pavlov</td>
<td>Conditioned response</td>
<td>Scope and sequence grid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Selection and writing of questions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others**</td>
</tr>
<tr>
<td>5. Guthrie</td>
<td>Transfer of training</td>
<td>Authentic measurements**</td>
</tr>
<tr>
<td>6. Piaget</td>
<td>Developmental learning</td>
<td>Standards</td>
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<td>Scope and sequence</td>
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<td>Unit plans</td>
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<td>Testing</td>
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<td>7. Tolman</td>
<td>Purposive behaviorism</td>
<td>Philosophy statement</td>
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<td>Curriculum content determinators</td>
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<td></td>
<td></td>
<td>Authentic measures</td>
</tr>
<tr>
<td>8. Norman</td>
<td>Information processing</td>
<td>Logical sequencing</td>
</tr>
<tr>
<td>9. Hebb</td>
<td>Sensory</td>
<td>Authentic measurements**</td>
</tr>
</tbody>
</table>

* Minor influence
** Major influence

Figure 16. Theories impacting the development of the TVSIM model
following: norm-referenced test of choice, competency based state standards, and authentic assessment. In reviewing the SIM concept many strengths were noted, together with several shortcomings, for the vocational/technology area. The strengths and advantages of SIM are plentiful, beginning with the stakeholders' committee concept which ensures that all facets of the education enterprise and the community have a share in the educational decisions (Manatt, 1993c).

SIM is a total-systems model led by experienced consultants who have been involved in continuous educational development since 1978. After the curriculum renewal process has been conducted, the teachers and curriculum developers possess a complete and detailed curriculum guide and criterion measures. Accountability of students, teachers, and administrators is thus assured.

Each step of SIM is clearly outlined with the responsibilities clearly delineated. Printed resources with explicit SIM instructions are provided for the committee members along each step of the way which decreases the chances for error and accelerates the process. The staff at the SIM office answers questions and queries throughout the curriculum procedure which is greatly appreciated by people in the field (Allen, 1993). The test questions which are linked to concepts within the curriculum, is a major benefit together with the coding each question to determine which concept is being tested. The test analysis provided by SIM to the districts is a service which enhances the testing procedure. The majority of the strengths of SIM have been mentioned; however, other advantages are inherent in the SIM model.

The shortcomings which were identified and which needed to be addressed
were the methods of establishing curriculum content, and the need to incorporate the sensori-motor skills which are highly utilized in the practical areas of education.

After considerable research and conversations with individuals, a model was developed. The model was presented before the knowledgeable panel and the panel responded with opinions, suggestions, and recommendations. The derived TVSIM model, having taken aspects of the SIM model, related aspects of the review of literature, experiences from curriculum experts and the knowledgeable panel's input.

It begins with the local school board(s) working in concert with the SIM team. The school board is asked to develop and have on hand, a curriculum policy statement. At this point, a stakeholders' committee is established, having representation from all the stakeholders in education. The stakeholders' committee establishes the curriculum committees and empowers them to review the subject area curriculum. The curriculum committee begins by establishing or revising the subject area philosophy statement and then decides on the curriculum content determinators.

The literature indicated that in the vocational/technology area there can be eight different inputs for curriculum content.

1. Advisory committee recommendations.
2. A review of the current literature, including journal articles, school college catalogs, and state curriculum guides.
3. Local research reports.
4. Professional association certification requirements.
5. Skill inventories.
6. Faculty recommendations.
7. Articulation agreements.
8. Program evaluation reports.

After the content has been identified standards are established, cost benefit analysis is conducted, program goals are developed, a scope and sequence grid is defined and unit plans are created. After all the parts of the curriculum are assembled, a draft of the curriculum is developed and appropriate revisions are made. Last, but not least, is the professional staff development of all the teachers.

**Identification of validation criteria**

A knowledgeable panel of educators was selected among educators in the field. The names and curriculum development experience of the panel members is shown in Figure 17. The questionnaire is located in Appendix D. The panel met on June 17, 1993, to discuss the following questions and to validate the (TVSIM) model:

1. *Does* the Technology/Vocational School Improvement Model (TVSIM) model portray a logical sequential process?
2. *Does* TVSIM appear to be functional?
3. *Does* the model provide for adequate local autonomy in planning the curriculum?
4. *Does* the model contain adequate flexibility to accommodate a greater emphasis on psychomotor assessment?
5. *Does* it appear that the model would be cost effective?
<table>
<thead>
<tr>
<th>NAME</th>
<th>CURRICULUM INVOLVEMENT</th>
<th>COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bax, Rashid</td>
<td>Min. of Educ. Scholar; Former Principal</td>
<td>Malaysia</td>
</tr>
<tr>
<td>Hawks, Ed</td>
<td>K-12 Curr. Coordinator</td>
<td>U.S.</td>
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<tr>
<td>Koester, Lisa</td>
<td>Phase 3 Curr. Facilitator</td>
<td>U.S.</td>
</tr>
<tr>
<td>Poston, Bill</td>
<td>Cert. (Lead) Curr. Auditor</td>
<td>U.S.</td>
</tr>
<tr>
<td>Wolansky, Bill</td>
<td>Ind. Ed. Curr. Professor</td>
<td>U.S.</td>
</tr>
</tbody>
</table>

Figure 17. Knowledgeable panel

6. *Does* the model lend itself to subject integration?
7. *Do* curriculum content determinators provide an adequate information source?
8. *Does* the model contain any redundant procedures that might be deleted?
9. *Does* there appear to be any additional steps that might be required to facilitate curriculum improvement?

**Measuring up to the program evaluation standards**

The questions placed before the knowledgeable panel were determined to fulfill numerous program evaluation standards. The standards that were most easily identified were: audience identification (secondary vocational/technology programs); evaluator credibility (experienced curriculum educators were on the panel); information scope and selection (validation criteria questions); and valuation
interpretation (the basis for value judgment clarified). These points are part of the utility standards which are intended to ensure the evaluation will serve the practical information needs of the given audiences.

The feasibility standards which are intended to ensure the evaluation will be realistic, prudent, diplomatic and frugal, were included as practical procedures, functionally and cost effective (cost benefit analysis). Accuracy standards which are intended to ensure that the evaluation will reveal and convey technically adequate information about the features that determine worth or merit of the model being evaluated, included object identification (the TVSIM model), context analysis, purposes and procedures.

**Recommendations of the knowledgeable panel**

The knowledgeable panel's analysis and recommendations are presented by each criteria question.

1. *Does the Technology/Vocational School Improvement Model (TVSIM) model portray a logical sequential process?*

   Three-fourths of the panel indicated that the model did portray a logical sequence. The two members who did not believe that the model portrayed a logical sequence suggested that the assessment model was too linear and there was a need to change the name of the test writers committee to assessment committee.

2. *Does (TVSIM) appear to be functional?*

   Seven of the eight members who responded to the criteria question did agree that the model was functional. The one panel member who disagreed, suggested that
pilot testing needed to be considered before the curriculum is implemented. Pilot testing was not added because in many smaller school districts most teachers in the curriculum area are employed to write the curriculum. Therefore, field testing is not required. Therefore, the teachers have input and first-hand knowledge of the curriculum and pilot testing is not required.

3. *Does the model provide for adequate local autonomy in planning the curriculum?*

All of the members of the knowledgeable panel agreed that the model did allow for adequate local autonomy, however, several comments did indicate that perhaps that there was too much local autonomy.

4. *Does the model contain adequate flexibility to accommodate a greater emphasis on psychomotor assessment?*

All members of the panel agreed that the model did contain adequate flexibility to accommodate a greater emphasis on psychomotor assessment. It was suggested that authentic assessment should focus on psychomotor and affective domains while the paper and pencil test be used for the cognitive domain.

5. *Does it appear that the model would be cost-effective?*

Seven of the eight panel members agreed that the model was cost-effective. The one dissenting member recommended that cost effectiveness be placed in the model to avoid large, unnecessary expenditures.

6. *Does the model lend itself to subject integration?*

All members of the panel agreed that the model did lend itself to subject integration and several commented that the model was strong in this area.

7. *Do curriculum content determinators provide an adequate information source?*
All members agreed that the curriculum content determinators do provide an adequate information source. One comment stressed inclusion of needs assessment.

8. *Does the model contain any redundant procedures that might be deleted?*

All panel members agreed that there were no redundant procedures.

9. *Does there appear to be any additional steps that might be required to facilitate curriculum improvement?*

All members agreed that there needed to be additional steps which should include a cost-benefit analysis, school board curriculum policy, pilot/field testing and a separate authentic testing pathway.

After the curriculum committee has completed its function, several teachers who have been members of this committee are employed as a subset which becomes the assessment committee. The assessment committee determines which concepts will be tested and the evaluation methodology. The evaluation may be done in two ways. The first is a paper and pencil criterion reference test where test questions are selected, written, and coded. This is used mainly for testing cognition. The second route is to develop authentic measures and establish criteria for these measures. This is best accomplished through a method known as SOLO (structured observable learner outcomes). SOLO involves the sequence of criteria through either a hierarchical system or subsequent procedural manner. The two evaluations are then combined into one instrument and drafted for a pilot test. The instrument in then field-tested and test analysis is conducted. Thereafter, the instrument is revised and prepared for pre- and post-testing.

Concerns were expressed by Bradshaw (1993) and others regarding the linking
of different measures, especially authentic and criterion. According to Mislevy (1992) the statistical framework exists. Therefore, the test questions and tests may be linked in several different fashions: equating, calibration and projection (Appendix E).

Recently Sanders (1993) demonstrated use of a statistical framework through a mixed model methodology ($M^3$) which is the undergird to the Tennessee Value Added Assessment System (TVAAS). This method provides solutions to many problems in comparing across subjects, grade levels, ethnicity, socio-economic status and other variables which have been impediments to the development of an equitable student outcome-based system in the past.

Proponents of the use of student achievement data as part of an educational outcome assessment system have recognized many inherent statistical problems that had to be overcome. Sanders developed the $M^3$ model by incorporating and augmenting Henderson's mixed model equations (MME). Some of the problems solved by this recent methodology include: (1) 'regression to the mean;' (2) missing student records; (3) various forms of classroom instruction (i.e., self-contained classroom vs. departmentalized instruction vs. team teaching etc.); (4) teachers changing assignments over years; (5) different variance-covariance structures among school systems; and (6) the opportunity to include concomitant covariables if needed.

Previous research directed by Sanders indicated that if this methodology were applied, then the influence of teachers and schools could be estimated independent of many socio-economic biases that had been an appropriate concern, historically. This recent breakthrough indicates that different measures can be valid and reliable
indicators of the influence of schools and teachers on student achievement with most
of the socio-economic confoundings filtered, without having a direct measure of
numerous concomitant variables.

Studies conducted in Canada by Jones-Delcorde (1993) contributed
significantly to impacting the development of the TVSIM model. Jones-Delcorde
advocated development of an integrated program which produces graduates who
think geometrically and can apply their knowledge base in practical situations. There
is an increasing concern that the concentrated level of academic theory in educational
systems today needs to be supplemented by demonstrated application to practical
situations. Jones-Delcorde insisted that the curriculum should seek to harmonize a
blending of theory and practice with a vision of a balance of academics, arts and
technology in an integrated approach to the curriculum and active learning. The
Technology/Vocational School Improvement (TVSIM) model is shown in Figure 18.

Phase Two - Findings

The phase two findings addressed Objective 8:

Objective 8: Determine if there is equality of student achievement as measured by
gain scores across all teachers.

The hypothesis which was tested is restated as follows:

There will be no significant differences in achievement of students as measured by
gain scores whose teachers:

1. had no involvement in the renewal and test development.
2. were involved in curriculum renewal.
3. were involved in the renewal and test development.
Figure 18. Technology/vocational school improvement model (TVSIM)
Ho: $\mu_1 = \mu_2 = \mu_3$

Ha: $\mu_1 \neq \mu_2 \neq \mu_3$

It is important to note that the only pre- and post-test data that were available to the present investigator during this research study were economics and government test results because they were semester courses.

To test the hypothesis, the SPSS-X repeated measures ANOVA procedure (using the MANOVA command) was used to analyze the data. Post hoc t-tests were conducted using the SPSS-X t-test procedure. Pooled variance estimates were used for the t-tests to better estimate the true variance. This approach is considered appropriate in the event of unequal sample sizes (Maxwell & Delaney, 1990).

Maxwell and Delaney stated that an analysis of gain scores is considered appropriate in those cases when the dependent variable(s) and the covariate(s) are deemed commensurable (i.e., related). Unless the analysis is one that is assessing the existence and effect of a covariate, the analysis of covariance is not appropriate. The significant question to be answered in the analysis of gain scores is, "Was there significant change from pretreatment to posttreatment" (p. 393)? This is a question frequently asked in applied settings of research. The ensuing analysis is rather straightforward then, and is identical to that of matched-pairs (dependent) variables consisting of the pre- and post test scores, which surely are correlated. Maxwell and Delaney stated that the aspects which are usually of interest to the researcher employing a gain score analysis are the degree of differences between pre- and post-tests between two groups, also the differences between the degree of correlation
between the pre- and post-tests between groups.

Rosenthal and Rosnow (1991) supported this view by explaining the comparisons which are used as dependent variables measures which are most likely correlated, t-tests for correlated data (dependent or non-dependent samples) are appropriate. The authors contend that calculated independent t statistics often are underestimates of the actual magnitude of the independent variable when non-correlated (independent) data are those that exist in repeated measures studies where the same subjects are measured twice in a pre-post fashion. It is appropriate then to use a dependent t-test analysis which assesses the differences between pre- and post-tests for a group or groups.

The SPSS-X Users Guide (1988) provided further evidence in supporting the concept. It states that when the analysis is one that compares the pre- and post-test scores for subjects, the proper analysis is the paired t-test analysis.

Summary of Phase Two Findings

The population of phase two comprised three groups of economics and government teachers (Table 3). Teachers in the first group were curriculum committee members. Members of group two were professional development teachers. Group three consisted of members of the curriculum committee and the test writers’ committee.

Using the pre- and post-test scores as dependent variables (repeated measures factors) and the teacher groups as the independent variable (between subjects factors) and repeated measures analysis revealed a statistical significance for the
Table 3. Population of phase two of the study

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Teachers</th>
<th>Number of Classes</th>
<th>Ave. No. of Students</th>
<th>Pre-test Mean</th>
<th>Post-test Mean</th>
<th>Ave. Gain Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>4</td>
<td>18.0</td>
<td>17.01</td>
<td>18.24</td>
<td>1.23</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>6</td>
<td>17.5</td>
<td>19.92</td>
<td>21.35</td>
<td>1.43</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>4</td>
<td>17.5</td>
<td>15.18</td>
<td>18.22</td>
<td>2.34</td>
</tr>
</tbody>
</table>

Group 1 = Curriculum committee  
Group 2 = Professional development teachers  
Group 3 = Curriculum committee and test writer’s committee

overall (omnibus) between subjects factors (F = 6.39; df = 2, 244; p = .002) (Table 4). The involvement of the teacher in the curriculum renewal, alignment and evaluation process does have a significant effect on the gain scores of the students. A statistically significant effect was also revealed within subjects by the analysis (F = 9.64; df = 1, 244; p = .002) (Table 5). The groups differed significantly at the pre- and post-test levels. No significant interaction effect was found.

Follow up (post hoc) t-tests (alpha level adjusted to control for experimental wise error; .05/6 = .008) revealed statistical significance in the following areas: between the curriculum committee group (mean = 19.069, s = 8.567, n = 72) and the inservice only group (mean = 22.513, s = 8.193, n = 105) for their pre-test scores (t = -2.70, df = 175, p = .008) (Table 6); and between the inservice (mean = 21.354, s = 6.358, n = 105) and the curriculum test writers group (mean = 17.63, s = 5.281, n = 70) on their post test scores (t = 4.05, df = 173, p = .0001) (Table 7).

Therefore, the null hypothesis was rejected and the alternate hypothesis accepted.

These results suggest that the teacher’s involvement in curriculum renewal,
Table 4. ANOVA tests of between-subject effects

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>F value</th>
<th>Sig. of F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within cells</td>
<td>19548.81</td>
<td>244</td>
<td>80.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher involvement</td>
<td>1024.02</td>
<td>2</td>
<td>512.01</td>
<td>6.39</td>
<td>.002</td>
</tr>
</tbody>
</table>

Table 5. ANOVA tests of within-subject effects

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>F value</th>
<th>Sig. of F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within cells</td>
<td>5726.40</td>
<td>244</td>
<td>23.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tests</td>
<td>226.16</td>
<td>1</td>
<td>226.16</td>
<td>9.64</td>
<td>.002</td>
</tr>
<tr>
<td>Teacher involvement</td>
<td>131.15</td>
<td>2</td>
<td>65.58</td>
<td>2.79</td>
<td>.063</td>
</tr>
</tbody>
</table>
Table 6. Post hoc t-tests of teacher involvement in curriculum and inservice

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of cases</th>
<th>Mean</th>
<th>SD</th>
<th>Std. error</th>
<th>F value</th>
<th>2-tail prob.</th>
<th>Pooled variance estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>72</td>
<td>19.07</td>
<td>8.57</td>
<td>1.01</td>
<td>1.09</td>
<td>.672</td>
<td>-2.70 175 .008</td>
</tr>
<tr>
<td>Group 2</td>
<td>105</td>
<td>22.51</td>
<td>8.19</td>
<td>.80</td>
<td>.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>72</td>
<td>18.93</td>
<td>7.54</td>
<td>.89</td>
<td>1.41</td>
<td>.111</td>
<td>-2.31 175 .022</td>
</tr>
<tr>
<td>Group 2</td>
<td>105</td>
<td>21.35</td>
<td>6.39</td>
<td>.62</td>
<td>.62</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7. Post hoc t-tests of teacher involvement in inservice, and curriculum and testing

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of cases</th>
<th>Mean</th>
<th>SD</th>
<th>Std. error</th>
<th>F value</th>
<th>2-tail prob.</th>
<th>Pooled variance estimate</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRE</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>105</td>
<td>22.51</td>
<td>8.19</td>
<td>.80</td>
<td>1.59</td>
<td>.041</td>
<td>1.76 173 .080</td>
</tr>
<tr>
<td>Group 2</td>
<td>70</td>
<td>20.46</td>
<td>6.50</td>
<td>.78</td>
<td>.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>105</td>
<td>21.35</td>
<td>6.36</td>
<td>.62</td>
<td>1.45</td>
<td>.100</td>
<td>4.05 173 .000</td>
</tr>
<tr>
<td>Group 2</td>
<td>70</td>
<td>17.63</td>
<td>5.28</td>
<td>.63</td>
<td>.63</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
alignment and evaluation does have an effect on the performance of the students. This is made evident first by the statistical significance of the overall F statistic for the between subjects factor, and by the post test t-test statistical significance between the inservice and the curriculum/test writers groups.

Of concern was the fact that there exists a statistically significant difference on the pre-test scores for the curriculum committee and the inserviced groups. With random sampling one would expect all groups to be near equal at the onset of the testing (pre-test). Since the test results were gathered from intact classes, it was not possible to randomly assign the subjects. The interpretation of the results is, therefore, undertaken cautiously.

The discrepancy was not very significant in a practical sense because a slightly more than 2% difference existed between the highest and lowest groups. The reason this statistical difference may have existed is that the best teachers were selected to be on the curriculum and test writer's committees for the SIM project. Therefore, the curriculum and test writers may have had an advantage over the other teachers prior to their involvement with the SIM project.

Another concern is that the significance found was in both cases due to the professional staff development teachers group's difference with one of the other two groups. This may be interpreted as evidence that having experience as a teacher with either or both curriculum and/or test development favorably biases the students' scores or that the inservice of the teachers was inadequate. For these reasons it must be stressed that the results should be interpreted with caution.
CHAPTER V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The first four chapters of this research study consisted of an introduction, review of literature, methodology, model development, statistical analysis, and findings. The purpose of this chapter is to summarize the results of the preceding chapters, discuss conclusions based on the research questions, and introduce recommendations for practice and further research studies.

Summary

The basic problem of this study was to investigate several aspects of the School Improvement Model and consider its applicability in addressing the needs of vocational/technological education at the secondary school level. In addition, the secondary goal was to determine if there was an equal opportunity for all students and teachers in the SIM method of curriculum renewal and alignment.

The study involved the possible modification of SIM for use with vocational/technology subjects (e.g., manufacturing, construction, electronics, etc.). In an effort to fully understand SIM, the present investigator did the following: (1) interviewed D. Manatt and S. Stow on numerous occasions; (2) read all publications that involved SIM; (3) read selected SIM files, i.e., contracts and sequenced training materials; and (4) conducted a telephone interview with P. Allen, the field officer in Monroe County, Florida.

The SIM model follows the sequence of philosophy statement, development of strands, program goals, scope and sequence grid, and unit plans. To fully understand
adaptations needed to incorporate vocational/technology subjects, the present investigator conducted the following investigations: (1) reviewed current vocational/technology literature to determine the focus of the area; (2) studied performance standards, tech prep, outcomes based education, subject integration and other relevant topics to determine how these new directions may be integrated into the derived model; (3) interviewed W. Wolansky and L. Bradshaw to determine if and how vocational/technology education could be applied to the SIM model in current and future practices; (4) reviewed the literature to understand unique aspects to be addressed in a vocational/technology model as differing from academic education; and (5) analyzed and synthesized knowledge acquired from different sources (literature review, discussion, etc.) to derive a vocational/technology model.

Conclusions

The results of the study indicate that it is possible to apply the School Improvement Model (SIM) for curriculum renewal, alignment and evaluation to the vocational/technology area. This section presents the responses to the research questions which guided this study.

1. What are the differences between the vocational/technology and the academic areas in regards to curriculum renewal and alignment?

Curriculum renewal in vocational/technology mirrors technology and technological change, and how they affect society. Therefore, curriculum renewal must be continuous and up-to-date with rapid changes occurring in the technical field. Unlike the academic areas which change slowly, periodically having different focuses
on teaching methodology or client learning styles, the vocational/technology instructor must not only be cognizant of professional changes but also occupational skill and knowledge changes as these must then be conveyed to the students.

One must, therefore, conclude that the vocational/technology area needs to place a great deal of emphasis on curriculum renewal and continual upgrading. While the issue of curriculum alignment is important in both the academic and vocational/technology areas, it must be mentioned that, because of a widespread use of performance standards in many occupational areas, the vocational/technology instructors may feel that they are more accountable than their academic counterparts to their students and employers of graduates.

Both vocational/technology and academic personnel must place a high emphasis on curriculum renewal and alignment but because of extenuating circumstances the vocational/technology students are more vulnerable if the instructor does not renew and align the curriculum on a frequent basis.

2. *How can the School Improvement Model (SIM) of curriculum renewal/alignment be applied to the vocational/technology area?*

The SIM model may be applied to the vocational/technology area with relative ease. A glance at the TVSIM model would indicate that essentially no steps were eliminated from the SIM model although several have been added. The steps which have been added were derived from either the literature or the knowledgeable panel. The steps that were added include: (a) a curriculum policy developed for the school board; (b) curriculum content determinators to assist teachers to align their curriculum with other agencies and institutions; (c) cost benefit analysis to determine
how much capital the new initiatives would require; and (d) an assessment methodology to determine how learner outcomes will be measured (see Figure 18).

3. Which are the necessary vocational/technology curriculum alignment steps that differ from the current SIM curriculum model?

The literature review indicated that several steps should be added to the TVSIM model. The first step would be the inclusion of curriculum content determinators (sources to investigate to assist in determining curriculum content), which assist the vocational/technology faculty to ascertain what the curriculum should include. The knowledgeable panel, on the other hand, suggested that the school board needs to develop a curriculum policy.

Provision for a cost-benefit analysis in the curriculum cycle to determine what costs (tools, equipment and materials) would be appropriate to teach certain skills and knowledge. The knowledgeable panel also suggested that the paper and pencil tests (measuring mostly the cognitive domain) be separated from the authentic measures which are intended to measure mostly the psychomotor and affective domain. In addition, authentic measures employing pre-tests may be inappropriate and, therefore, should only be utilized when appropriate.

4. How can perceived differences between the academic and the vocational/technology areas be accommodated in the model?

The perceived differences can be accommodated through some additional steps within the model allowing for the assessment of psychomotor skills and the inclusion of content determinators. The knowledgeable panel felt that the TVSIM model had its greatest strengths in terms of subject integration, which would allow the model to
be used for both academic and vocational/technology. This could have potential for curriculum reform concepts such as tech prep which uses the integrated curriculum approach.

5. **Do other curriculum reform concepts offer potential advantages which might well be applied to the vocational/technology area or adapted into the current SIM model?**

Through the literature research it was found that many concepts may be blended or incorporated into the TVSIM model. Competency based education offers strategic skills and knowledge which lends itself to assist in the determination of standards at each level. Subject integration is the wave of the future and with the knowledgeable panels indication that TVSIM had it greatest strengths in this area it would be appropriate to assume that it may be widely utilized for this purpose. Authentic assessment had a relatively large impact upon the model allowing the vocational/technology area to measure both psychomotor and affective domains. C-TAP and performance standards could be utilized to determine standards within certain segments of the vocational/technology area.

TVSIM greatly uses and stresses multiple instrument testing as well as different assessment approaches in an attempt to help determine what has actually been learned. The outcomes portion of curriculum reform had an impact on the model in determining what the curriculum content will be and what the learners outcomes are expected to be. The SOLO model has many advantages and was perhaps the single most useful item in assisting to develop criteria for the authentic assessment portion of the model.
6. *How do student evaluation procedures and approaches in the vocational/technology areas differ from those currently used in the SIM model for academic subjects, and yet achieve the desired results?*

Rather than using the consistent paper and pencil tests to measure cognitive knowledge as is the case with SIM, TVSIM has moved to the utilization of both paper and pencil as well as authentic assessments. The authentic assessment portion is to measure the psychomotor (skills and knowledge) and affective (knowledge and behavior) domains. The authentic measures need to be defined through a criteria method. The SOLO method appears to be the best suited to develop criteria. Within the SOLO method, criteria may be established in several different ways. The most common way of setting up the criteria is to define responses or procedures in a hierarchical manner, that is, going from the less difficult to the more difficult usually within a five step series. The other method is to determine several (usually five) procedures of arriving at the end product and having the learner be able to complete as many as possible in an effort to demonstrate mastery. Therefore the significant differences between the two models lie in the inclusion of authentic assessment through the SOLO method.

7. *Do all students have the advantages of the renewed curriculum regardless of the level of involvement of their teachers in curriculum renewal and test development?*

The null hypothesis, *there were no differences in student achievement as measured by gain scores with different teacher involvements*, was rejected. Therefore, the alternate hypothesis was accepted because a significant difference of student gain scores did exist between the three groups of teachers. There was a significant difference between the inservice group and the other two groups (curriculum renewal
and renewal and test development). It would appear that there is an association between teacher involvement and student achievement. However, because there was a small number of students and the analysis was limited to only government and economics courses, the results should be interpreted with caution.

The SIM originators believe that getting the curriculum done is like breaking through a large snow pile and then clearing the fringe areas. The SIM model utilizes a design build concept where the model is first designed and then it is built and used. Many other curriculum specialists believe that curriculum must be designed, tested, modified and then implemented. The SIM model is far less costly and can be implemented during a short time span by moving directly from the design concept to building the curriculum, and then modifying it if necessary.

Limitations of the Study

The following were limitations of the study.

1. The investigation was limited to selected literature resources, Monroe county data, and telephone and personal interviews with knowledgeable people in the field.

2. The study did not attempt to compare the relative importance of different subject areas, such as vocational/technology, math, language arts, etc.

3. The study was limited by the researcher's analysis and the presentation of the analysis data in view of time and financial resources.

4. Since the population consisted of schools of SIM projects, the findings may not necessarily be generalizable to other educational settings. However, due to the
broad-based nature of the derived TVSIM model, it may be applied to other educational organizations who are interested in curriculum renewal, alignment and assessment for vocational/technological programs.

Discussion

The world is changing, and as it does it is becoming more complex and demanding ever higher levels of knowledge and skills. It is generally assumed that a well-educated country is one that will enjoy a high standard of living. In a democracy, there surely is no greater risk than allowing citizens to become or remain poorly educated. During the 1980s the awareness was raised and education became increasingly important to economic competitiveness. Now, in the 1990s, the importance of education has increased to the point where it may be the single most important factor influencing the success of the nation. All nations must strive to increase the skills of their citizens.

Education is almost uniquely responsible for helping people get the knowledge, skills and abilities necessary for success, and the higher skilled individuals generally are more productive and have more ready access to continued education. To increase productivity, worker skills need to be expanded. Today, because of technological advances, workers are either required or expected to know and be able to do much more.

In the age of accountability the educational system is being challenged and closely scrutinized. Business and industry claim that they are not able to employ the students with the necessary skills and knowledge. As confidence decreased in the
public education system numerous accountability measures were put into place. The most widely used and known accountability instruments are the standardized tests.

Unfortunately, standardized tests do not necessarily measure what the student has learned. As the public and the educational system struggle to find a solution, other methods have evolved and are beginning to receive a wider range of acceptance. Many educational reformers speak of the utilization of standards, whether they be performance standards for programs, skill standards for occupations, or world class standards for students, the basis for any discussion of standards is a belief that all must begin to look at education by what is produced, not what is consumed. That is, definitions should be produced in regard to the what the results of the educational efforts ought to be and judged against these criteria, not simply on input-indicators such as numbers of students served, amount of time spent on programs, or how much money was invested. The process for setting standards should be viewed strategically; it forces those involved to look ahead and determine what students, young and old, should know. It requires consensus among those involved, and it will help to highlight common goals and objectives.

The School Improvement Model (SIM) has many of the above mentioned benefits. There needs to be consensus from the stakeholders' committee as well as other committees and individuals involved in an effort to achieve curriculum reform. The educators develop standards they wish to achieve and build programs and unit plans around these standards and outcomes. The objective of curriculum renewal is to assure that the students are taught what they need to be taught and taught to the
appropriate mastery level. Curriculum alignment, on the other hand, is an attempt to ensure that the written curriculum matches the taught curriculum, and the evaluated curriculum. Simply put, is the teacher teaching what is written in the curriculum, and do the student gain scores reflect that this written curriculum was taught?

The attempt of the School Improvement Model (SIM) is to standardize the educational experiences across the district. With standardization, performance standards may be attached which allows school districts to claim that the students have the necessary skills and knowledge for employment. This concept has come to fruition in Georgia, where several school districts and colleges guarantee the knowledge and skills to business and industry in their field of training. The guarantee states simply that if a graduate is found deficient in one or more competencies, he or she will be retrained at no additional cost to the employer or employee.

The present investigator found that SIM began with a stakeholders' committee that employed subject area curriculum committees. The subject area curriculum committees, with the assistance of the SIM team, determined the gap and then they developed a philosophy statement. Afterward, they determined if the curriculum needed to be renewed or if it could be retained. If the curriculum was to be renewed, content standards were determined, program goals established, a scope and sequence grid was developed and then unit plans were created. The curriculum was now in a draft stage wherein revisions could be made before the professional development workshop was held for all subject area teachers.
A sub-set of the curriculum committee members then became the test writers’ committee. This committee selected, wrote, and coded the test questions to match learner outcomes. Then the committee revised the questions, drafted a pilot test, and conducted the pilot test. The SIM team then conducted a test analysis after which the test was revised and copies of the pre- and post-tests were duplicated for administration to students. The criterion-referenced measures are installed in a software package called *Performance Plus* and sold by NCS Corporation. This package provides formative as well as summative testing with progress reports for students, parents and teachers.

The literature review and knowledgeable panel suggested that some additions be made to the TVSIM model to ensure effective delivery in the vocational/technology area. The school board needs to establish a curriculum policy (English, 1992). This need was supported by the knowledgeable panel. The literature revealed that the vocational/technology area required the use of content determinators to establish curriculum content (Homer, 1985; Walter, 1988). The knowledgeable panel suggested that a cost benefit analysis should be conducted in an effort to assure that the high cost of new technology will benefit as many students as possible.

The test writers’ committee from the SIM II model was changed to the assessment committee at the request of the knowledgeable panel because the vocational/technology area focused more heavily on the psychomotor and affective domains than any academic area (Bott, 1987; Wolansky, 1985). When employing
authentic measures, TVSIM advocates the SOLO method of assessment which integrates more than one domain and in several combinations.

SIM II was built upon a strong foundation, using principles and theories from Taba and Tyler. In addition, Thorndike's teaching and learning theory impacted on the scope and sequence grid whereas the use of standards, unit plans and testing were influenced by Piaget.

TVSIM embraces the underlying theories of SIM and anexes the theories of Hebb, Guthrie and Skinner to emphasize the necessity for psychomotor and authentic assessments in the vocational/technology area. TVSIM also utilizes Skinner's theories and research findings to develop curriculum content determinators.

Many parts of curriculum models, frameworks and methods have been implemented in the TVSIM model as indicated in the review of literature. The curriculum development framework of SIM relates closely to the Finch and Crunkilton vocational model, allowing for a transfer from the academic SIM model to the vocational/technology TVSIM model. Task analysis, competency-based education, performance standards and C-TAP are important to vocational/technology in delineating job standards.

The SOLO and multi-instrument testing evaluation models are regarded as best suited for evaluation purposes in TVSIM because they incorporate different methods of assessment using more than one domain simultaneously and in various combinations.

Authentic and psychomotor assessment are vitally important to TVSIM. It
must be noted, however, that authentic assessment is time-consuming and thereby a costly method of evaluation. It is with a strong conviction for quality assessment in the vocational/technology area that the researcher urges practitioners to utilize authentic assessment as fully as possible.

In addition, subject integration and tech prep have great potential and can be easily consolidated into TVSIM, following the current trend of vocational/technology toward integration of subject/content areas. The potential benefits of theory with practice basically mean better, more well-rounded individuals who are creative and have the ability to solve problems—what business and industry desire of vocational/technology education.

With these specific changes and additions, it is the opinion of the present investigator that TVSIM will serve the vocational/technology area very well. The derived TVSIM model indirectly addresses a number of issues which business and industry have identified as important to education (Gibb, 1987). According to business and industry, education must shift from the old paradigm which focused on the past and seek to stress the future; develop creativity, insight, active understanding; inspire active involvement; and be opportunistic.

The significance of the model is that it incorporates several steps vital to the vocational/technology field. The question of what should be considered for curriculum content is answered with the curriculum content determinators. Of relevance to the vocational/technology field is the cost benefit of curriculum offerings and that is addressed by the curriculum committee. Of major importance is the
incorporation of authentic assessment to better evaluate the relevant psychomotor and affective domains. Together with the authentic assessment the suggested Structured Observable Learner Outcomes SOLO have potential value in developing assessment criteria for all vocational/technology programs.

Curriculum change as any other change is always difficult. A great deal of work, vision and effort are required in developing a curriculum. However, many educational transformationalists predict that if curriculum reform emphasizing real world experiences, theory accented with practice and accountability of all is not forthcoming, then traditional education as we know it could find itself as an endangered species. The TVSIM could be seen in such a context as vital to both academic and vocational/technology education.

The findings for the statistical part of the study might be due to several reasons. The sample size was relatively small with only six teachers; two on the curriculum committee and one being a test writer. With only four teachers in the inservice group only two had received the professional staff development. The other two teachers; one a new employee and another who transferred in from another subject and grade level, did not receive adequate professional staff development because of the advent of hurricane Andrew just prior to the start of school in the Fall of 1992 (Allen, 1993). As such, the findings should be interpreted with caution.

The researcher notes with pride that TVSIM was able to be built upon such a successful model as SIM II. In speculation, whatever direction vocational/technology education pursues in the future, TVSIM will be in all likelihood a model to be
embraced. It is alarming that there has been a lack of research and development of vocational/technology models that focus on current, societal needs.

Historically, when the economy has been in a recession, academic education was emphasized while vocational/technology was de-emphasized. When the economy drops and finances are reduced, administrators and leaders should look to remove the weak link from the educational chain. Vocational/technology education is costly yet lacks significant direction and research. Currently, the economy is not only poor and there is dire need to refocus both academic and vocational/technology education, but also there is pressure from all public sectors, including all citizens, not only business and industry, politicians and taxpayers. Will vocational/technology education continue to be the weak link or will it move toward recapturing the leadership in educational and innovative research?

**Recommendations for Practice**

There are several recommendations for practice which were brought forth by the research. It is strongly suggested that the TVSIM model be tested to determine the strengths and weaknesses of the model. After the testing has been completed, student achievement scores should be accessed and a direct study made as to its impact on student achievement using gain scores from the vocational/technology area.

Although not addressed in this study the vocational/technology areas are usually very diverse. Therefore, with the diverse areas, it is difficult to have committee groupings of each area, especially in one school district. The practice of
grouping several school districts to form consortiums would increase the number of instructors and, thereby, allow for diverse area groupings within the vocational/technology area.

The findings revealed that students whose teachers were not involved or lacked inservice training did not achieve as well as those students whose teachers were involved in curriculum planning and test writing, and who participated in the professional staff development inservice. Therefore, it is recommended that all teachers be involved in appropriate professional staff development regarding the use of the renewed curriculum.

Many school districts, graduate students, teachers, and researchers would better understand the SIM II concept if it were displayed as a complete model. The present investigator recommends that school districts use SIM to renew the academic areas and TVSIM to renew and align the vocational/technology areas. Monroe County, Florida, having had the SIM II experience, could possibly continue with TVSIM.

The SIM team should place more emphasis on the authentic assessment aspect of curriculum assessment. If the direction is to focus on skill subjects such as physical education and vocational/technology, then psychomotor analysis is an important factor and should not be overlooked but rather researched more closely, and implemented and evaluated with prudence.
Recommendations for Further Research

The present research brought forth a number of concepts which would be applicable for further research. Although the aspect of Structured Observable Learner Outcomes (SOLO) is a relatively foreign concept in the United States, this researcher is of the opinion that SOLO should be further researched especially for its applicability to psychomotor skills. Another area of research that would prove valuable is the statistical tieing of different evaluations. This will enable educators to equate, calibrate, and project different scores obtained from differing conceptualizations of assessment (e.g., comparing authentic, traditional, criterion-referenced, and/or standardized assessments).

The present investigator suggests that an assessment of student gain scores from Monroe County be made, incorporating all subjects and grade levels in an effort to attain a truer representation of the equal opportunity for achievement by all students. The TVSIM model needs to be further developed in a school district and tested to determine its viability as well as areas needing revision to enhance its usefulness in vocational/technology education.

Finally, TVSIM should be explored as a solution to curriculum reform that must emphasize real world experiences, theory accented with practice and accountability. It should not be overlooked that consolidation of subject integration and tech prep into the TVSIM model, following the current trend of vocational/technology toward integration of subject/content areas, offers a potential source of federal funding with monies from the Carl Perkins Act. TVSIM's
integration of both academic and vocational/technology education provides not only a suitable justification for further development, but also a strong rationale for financial support for further development of the TVSIM model.
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ACKNOWLEDGEMENTS

I can do everything through Him who gives me strength. Philippians 4:13

Many people rightfully share in the celebration of success which results from the completion of my doctoral program. I wish to thank my parents who instilled in me an insatiable desire to learn, and do my best at every task. I especially thank my dear wife, Betty, and my beautiful daughter, Darla, whose love, patience, and support were with me throughout my studies at Iowa State University. I am also indebted to my parents-in-law and find it difficult to express the extent of my gratitude.

Several colleagues and mentors were responsible for planting the seed of belief that I was capable of meeting the challenges of this endeavor. I wish to acknowledge my good fortune and privilege of having been encouraged, prepared and supported by such notable educators as Dr. Myron Bender, Dr. Lauvern Eickhoff, Dr. Dave Kingsbury, Dr. Robert Anderson, Dr. Harlon Scheer, Mr. Bill Macfarlane and Mr. Alf Klassen. I sincerely hope that my efforts and work meet their high expectations and standards of quality.

I especially want to extend my sincerest appreciation to the members of my doctoral committee. It is because of their efforts, commitment and support that I consider my pursuit at Iowa State University to be a very rewarding experience. Drs. Richard Manatt and William Wolansky truly personified everything I had ever envisioned and expected in a major professor. Professor Manatt's commitment to being available, regardless of the time, day, or schedule, was truly exceptional. Professor Wolansky's devotion to his students, patience, understanding, guidance and
unqualified support was without precedent. Working with such distinguished professors was truly rewarding. Dr. Larry Bradshaw caused me to think, analyze problems, and answer questions with all the ability I possessed. At the same time, his individual and personal support of my research efforts and friendship were invaluable. Dr. Robert Strahan, whose assistance with statistics procedures was greatly appreciated, all the while knowing that his goal was of having me use in the real world of schools what we learned in class, has been achieved. Dr. Bill Liu whose short stay at Iowa State University had a lengthy impact on me as he guided and encouraged each and every student he met. Dr. Charles Railsback reminded me that excellent teachers continue to demonstrate a desire to learn. Regardless of time constraints, Professor Railsback always had time to listen and dialogue regarding educational issues. Dr. Robert Martin, although a late comer on the committee, has been thorough and challenging. I am humbly grateful that he had taken on this responsibility. On short notice, Dr. John Riley agreed to substitute in final oral defense for Dr. Wolansky whose illness curtailed his desire to be there. Dr. Riley’s insightfulness and years of experience contributed greatly to the finishing touches to perfect this research.

I also wish to extend my appreciation to my partners, students and friends who personally assisted me with this endeavor. Anthony Stevens for his assistance in statistics, just in the time of need. Rashid Bax for his technical editing, organizational guidance and suggestions which strengthened my study. Ted Bensen and Todd Jacobs for the graphic design and color reproduction of the TVSIM model.
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A special note of recognition and appreciation to Dr. Bill Poston who encouraged me to reflect on my experiences and use them to build upon and to change. To all my professors, my sincerest appreciation for sharing your knowledge, skills and experiences. I trust I have learned your lessons well.

To all the secretaries in the Department of Professional Studies, I offer countless words of thanks and appreciation for all the ongoing support, extra effort, and the personal touch—it was valued.

My time and experiences at Iowa State University have been rewarding. I have grown personally and professionally, thank-you to each and everyone of you for allowing me to do so.

May the Lord bless you all!
APPENDIX A: COMMITTEE ON STANDARDS FOR EDUCATION EVALUATION
THE PROGRAM EVALUATION STANDARDS

Summary of the Standards

Utility Standards
The utility standards are intended to ensure that an evaluation will serve the practical information needs of given audiences.

U1 Audience Identification Audiences involved in or affected by the evaluation should be identified, so that their needs can be addressed.

U2 Evaluator Credibility The persons conducting the evaluation should be both trustworthy and competent to perform the evaluation, so that the evaluation findings achieve maximum credibility and acceptance.

U3 Information Scope and Selection Information collected should be of such scope and selected in such ways so as to address pertinent questions about the object of the evaluation and be responsive to the needs and interests of specified audiences.

U4 Valuational Interpretation The perspectives, procedures, and rationale used to interpret the findings should be carefully described, so that the bases for value judgments are clear.

U5 Report Clarity The evaluation report should describe the program being evaluated, including its context, and the purposes, procedures, and findings of the evaluation, so that essential information is provided and easily understood.

U6 Report Timeliness and Dissemination Evaluation reports and significant interim findings should be disseminated to clients and other right-to-know audiences, so that they can be used in a timely fashion.

U7 Evaluation Impact Evaluations should be planned, conducted, and reported in ways that encourage follow-through by members of the audiences, so that the chances of the evaluation being used are improved.

Feasibility Standards
The feasibility standards are intended to ensure that an evaluation will be realistic, prudent, diplomatic, and frugal.

F1 Practical Procedures The evaluation procedures should be practical, so that disruption is kept to a minimum and needed information can be obtained.

F2 Political Viability The evaluation should be planned and conducted with anticipation of the different positions of various interest groups, so that their cooperation may be obtained, and so that possible attempts by any of these groups to curtail evaluation operations or to bias or misapply the results can be averted or counteracted.

F3 Cost Effectiveness The evaluation should produce information of sufficient value, so that the resources expended can be justified.

Propriety Standards
The propriety standards are intended to ensure that an evaluation will be conducted legally, ethically, and with due regard for the welfare of those involved in the evaluation, as well as those affected by its results.

P1 Service Orientation Evaluations of programs, projects, and materials should be designed to assist organizations to provide services of high quality, so that needs of learner development are met.

P2 Formal Obligations Obligations of the formal parties to an evaluation (what is to be done, how, by whom, when) should be agreed to in writing, so that these parties are obligated to adhere to all conditions of the agreement or formally to renegotiate it.
**Propriety Standards (continued)**

P3 Rights of Human Subjects Evaluations should be designed and conducted, so that the rights and welfare of the subjects are respected and protected.

P4 Human Interactions Evaluators should respect human dignity and worth in their interactions with other persons associated with an evaluation, so that participants are not harmed or threatened.

P5 Full and Fair Reporting The evaluation should be full and fair in its presentation of strengths and weaknesses of the object being evaluated, so that strengths can be built upon and problem areas addressed.

P6 Disclosure of Findings The formal parties to an evaluation should ensure that oral and written evaluation reports are open, correct, and honest in their disclosure of pertinent limitations and findings, so that the right to know by persons affected by the evaluation, and any others with expressed legal rights to see the results, is respected and assured.

P7 Conflict of Interest Conflict of interest, frequently unavoidable, should be dealt with openly and honestly, so that it does not compromise the evaluation processes and results.

P8 Fiscal Responsibility The evaluator's allocation and expenditure of resources should reflect sound accountability procedures and otherwise be prudent and ethically responsible, so that there is no question about how evaluation resources are spent.

**Accuracy Standards**

The accuracy standards are intended to ensure that an evaluation will reveal and convey technically adequate information about the features that determine worth or merit of the object being evaluated.

A1 Object Identification The object of the evaluation (program, project, material) should be sufficiently examined, so that the form(s) of the object being considered in the evaluation can be clearly identified.

A2 Context Analysis The context in which the program, project, or material exists should be examined in enough detail, so that its likely influences on the object can be identified.

A3 Described Purposes and Procedures The purposes and procedures of the evaluation should be monitored and described in enough detail, so that they can be identified and assessed.

A4 Defensible Information Sources The sources of information should be described in enough detail, so that the adequacy of the information can be assessed.

A5 Valid Measurement The data-gathering procedures should be chosen or developed and then implemented in ways that will assure that the interpretation arrived at is sufficiently valid for the intended use.

A6 Reliable Measurement The data-gathering procedures should be chosen or developed and then implemented in ways that will assure that the information obtained is sufficiently reliable for the intended use.

A7 Systematic Data Control The data collected, processed, and reported in an evaluation should be reviewed and corrected, so that the results of the evaluation will not be flawed.

A8 Analysis of Quantitative Information Quantitative information in an evaluation should be appropriately and systematically analyzed to ensure supportable interpretations.

A9 Analysis of Qualitative Information Qualitative information in an evaluation should be appropriately and systematically analyzed to ensure supportable interpretations.

A10 Justified Conclusions The conclusions reached in an evaluation should be explicitly justified, so that the audience can assess them.

A11 Impartial Reporting Reporting procedures should guard against distortion by personal feelings and biases of any party to the evaluation, so that evaluation reports fairly reflect the evaluation findings.

A12 Metaevaluation The evaluation itself should be formatively and summatively evaluated against these and other pertinent standards, so that its conduct is appropriately guided and, on completion, audiences can closely examine its strengths and weaknesses.
APPENDIX B: LETTER OF PERMISSION TO USE DATA

DATE: June 23, 1992

TO: Dick Manatt, Director
School Improvement Model Projects
N239 Lagomarcino Hall
Iowa State University
Ames, Iowa 50010

FROM: A. J. Henriquez, Superintendent
Monroe County Schools

RE: Approval to use criterion-referenced test data for the dissertation of Mr. Gary Schnellert.

You have my approval to use the pretest/post test criterion-reference test data from the Monroe County Schools for the years of 1991 and 1992 to examine the advantage, if any, of being the original test developer in the final test results. I understand that all results will be held confidential and that only combined test data will be used in the study, therefore, no individual teacher or school will be identified in the tables.
APPENDIX C: WESTERN HILLS AREA EDUCATION CONCEPTUAL MODEL
Western Hills Area Education Conceptual Model

School Improvement
(Planning and writing plans at both the building and district levels focusing on:)
- Climate
- Instructional Focus
- Instructional Leadership (District)
- Instructional Leadership (School)
- Measurement
- Teacher Behavior (High Expectation)
- Parent/Community Interaction

Assessment

Climate
- Classroom Management
- T.S. of T.
- Learning Styles

Instructional Focus
- Instructional Leadership (District)
- Instructional Leadership (School)
- Measurement
- Teacher Behavior (High Expectation)
- Parent/Community Interaction

Professional Growth Alliance
- Service Coordination

Assessment
- Curriculum
- Instruction
APPENDIX D: KNOWLEDGEABLE PANEL QUESTIONNAIRE
TECHNOLOGY/ VOCATIONAL SCHOOL IMPROVEMENT MODEL (TVSIM)
KNOWLEDGEABLE PANEL QUESTIONNAIRE

1. Does the Technology/Vocational School Improvement Model (TVSIM) model portray a logical sequential process?
   YES ____; NO ____; Recommendations: __________________________________________________

2. Does (TVSIM) appear to be functional?
   YES ____; NO ____; Recommendations: __________________________________________________

3. Does the model provide for adequate local autonomy in planning the curriculum?
   YES ____; NO ____; Recommendations: __________________________________________________

4. Does the model contain adequate flexibility to accommodate a greater emphasis on psychomotor assessment?
   YES ____; NO ____; Recommendations: __________________________________________________

5. Does it appear that the model would be cost effective?
   YES ____; NO ____; Recommendations: __________________________________________________

6. Does the model lend itself to subject integration?
   YES ____; NO ____; Recommendations: __________________________________________________

7. Do curriculum content determinators provide an adequate information source?
   YES ____; NO ____; Recommendations: __________________________________________________

8. Does the model contain any redundant procedures that might be deleted?
   YES ____; NO ____; Recommendations: __________________________________________________

9. Does there appear to be any additional steps that might be required to facilitate curriculum improvement?
   YES ____; NO ____; Recommendations: __________________________________________________
APPENDIX E: METHODS OF LINKING EDUCATIONAL ASSESSMENT
# Methods of Linking Educational Assessments

<table>
<thead>
<tr>
<th>Link</th>
<th>Description</th>
<th>Procedure</th>
<th>Example</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equating</td>
<td>Equated scores from tests taken to provide equivalent evidence for all conjectures.</td>
<td>1. Construct tests from same blueprint.</td>
<td>Two forms of a driver’s license test, written to the same content and format specifications.</td>
<td>Foundation is not statistical procedure but the way tests are constructed.</td>
</tr>
<tr>
<td></td>
<td>Score levels and weights of evidence match up between scores on tests.</td>
<td>2. Estimate distribution of tests in given population.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Make correspondence table that matches distributions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>Tests “measure the same thing,” but perhaps with different accuracy or in different ways.</td>
<td>Case 1: Use same content, format, and difficulty blueprint to construct tests, but with more or fewer items on different tests. Expected percents correct are calibrated.</td>
<td>Case 1: A long form and a short form of an interest inventory questionnaire.</td>
<td>Correspondence table matches up “best estimates,” but because weights of evidence may differ, the distribution of “best estimates” can differ over tests.</td>
</tr>
<tr>
<td></td>
<td>Results from each test are mapped to a common variable, matching up the most likely score of a given student on all tests.</td>
<td>Case 2: Construct tests from a collection of items that fits an IRT model satisfactorily. Carry out inferences in terms of IRT proficiency variable.</td>
<td>Case 2: NAEP geometry subscale for grades 4 and 8, connected by IRT scale with common items.</td>
<td>Same expected point estimates for individual students, but with differing accuracy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Case 3: Obtain judgments of performances on a common, more abstractly defined variable. Verify consistency of judgments (varieties of statistical moderation).</td>
<td>Case 3: Judges’ ratings of AP Studio Art portfolios including student-selected art projects.</td>
<td>Different estimates of many group characteristics, e.g., variance and population proportion above cut point.</td>
</tr>
<tr>
<td>Projection</td>
<td>Tests don’t “measure the same thing,” but can estimate the empirical relationships among their scores.</td>
<td>Administer tests to the same students and estimate joint distribution. Can derive predictive distribution for Test X performance, given Test Y observation. Can be conditional on additional information about student.</td>
<td>Determine joint distribution among students’ multiple-choice science scores, lab notebook ratings, and judgments of observed experimental procedures.</td>
<td>What Test Y tells you about what Test X performance might have been. Can change with additional information about a student.</td>
</tr>
<tr>
<td></td>
<td>After observing score on X, you can calculate what you’d be likely to observe if X were administered.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Estimated relationships can vary with the group of students in the linking study and over time in ways that distort trends and group comparisons.