ANALYSIS OF THE INSTRUCTIONAL DELIVERY SYSTEMS FOR COMPETENCY-BASED VOCATIONAL EDUCATION IN THE AREA VOCATIONAL-TECHNICAL SCHOOLS OF OKLAHOMA

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CHAPTER I

INTRODUCTION

Competency Based Vocational Education (CBVE) has been shown to be a most effective system for developing vocational and technical curricula. CBVE focuses on occupational competencies, performance of these competencies, assessment, student progress through a program and overall intent of the instructional program. The foundations of CBVE are built on two basic principles:

1. The knowledge, skills, and behaviors to be demonstrated by the learner are derived from a task analysis of worker roles as stated in behavioral terms.

2. The criteria used to assess competencies are taken from the task analysis. Assessment of competencies must reflect both the level of acceptable performance and the conditions associated with the occupation.

Competencies for vocational and technical education are those tasks, skills, attitudes, values and appreciations that are critical to employment. Progress through a course of instruction is based on students mastering each competency to the standards of the profession. The specific intent of CBVE is employment.

Although elements of CBVE started appearing in print as early as the 1930's, and laws like the 1984 Carl D. Perkins Act which encouraged

CBVE development, implementation have not been easy. Weber (1988) in a study of 120 high schools and 893 related classrooms stated:

> In order to develop a national view of the extent to which secondary vocational curricula are competency-based, course syllabi were reviewed and several related items were included in the project instruments. Generally, the results obtained through these sources indicate that competency-based strategies and procedures are in use in 60 to 80 percent of vocational programs. At the same time, however, it was difficult to gain from the available data any insights into the quality of the competency-based approaches used or into the extensiveness with which they have been implemented. For example, a number of the syllabi reviewed for the different vocational programs included competency listings cast in the form of progress charts, but little more. In other instances, the correspondence between competency listings and specific program-related materials/activities were not made explicit. Some teachers had to search 'long and hard' even to find their course syllabi, which clearly suggested that they were used infrequently during the day-to-day instructional process (p. 19).

Weber is stating that what people say and what they do are not always the same.

CBVE is an effective system for collecting and developing course materials, but little is said about how to deliver the instruction. In fact, instructional design for delivery is of minimal concern in CBVE, as a 1985 State of Florida Division of Vocational, Adult and Community Education report stated:

> CBVE is concerned little with how the competencies are to be learned. It is possible to use many methods of teaching: large group instruction, small group instruction, independent study, projects, textbooks, etc. However, because mastery of competencies is required, and because individuals learn at different rates, CBVE programs tend to move logically toward some form of self-pacing and individualization. Note, however, that these approaches are facilitating, not essential, elements of CBVE (p. 6).

In other words CBVE and individualized instruction are not synonymous. Individualized instruction is not required but is seen as a means of enhancing CBVE. Individualized instruction is used as a greater

assurance of meeting student needs and to provide a learning experience that align with personal capabilities. Therefore, the most effective CBVE instructional delivery systems are those that allow for mastery learning and use individualized instruction (Finch and Crunkilton, 1989).

Statement of the Problem

Competency Based Vocational Education (CBVE) used in Oklahoma Area Vocational Schools is at various stages of development depending on how long each school has been using competency based instruction. The problem is that a lack of knowledge exists as to the extent to which Oklahoma area schools have implemented competency based instruction and whether the instructional delivery systems commonly in use are designed for the most effective results.

Purpose and Research Questions

The purpose of this research project is to gain insight into the extent to which CBVE has been implemented into the area schools of Oklahoma and to determine if the CBVE instructional delivery systems commonly in use are designed for the most effective results. Specific research questions for the study were:

1. What are the most effective mastery learning instructional delivery systems used in educational institutions today, as identified by a review of literature?

2. To what extent has Oklahoma Area Vocational Technical Schools implemented competency based vocational education?

3. What are the characteristics of the CBVE instructional delivery systems as they exist in the Area Vocational Technical Schools of Oklahoma?

Assumptions

The following assumptions were accepted in order to conduct the study:

1. The collected data were accurate.

2. That the information provided by the area school personnel was about curriculum materials actually used to operate each program on a daily basis.

Limitations

1. The subjects of this study was limited to the administrators and instructors from Area Vocational Technical Schools of Oklahoma.

2. The study relied almost exclusively on the self-reports of area school personnel to determine the extent of CBVE implementation as well as other information. Due to limited resources and time, it was not possible to verify through first-hand observations the ongoing implementation of CBVE in the area schools.

Definition of Terms

Some terms and phrases particular to this study are listed below. Other terms included are more common but may need clarification or limitation for purposes of this study.

Competency-Based Education (CBE): CBE or competency-based instruction is an outgrowth of the "systems approach" for curriculum

development. Under this approach, systematic instructional design takes into account the student, learning environment, content, technology, learning theory, and instruction (Elias and Merrian, 1980).

Competency-Based Vocational Education (CBVE): Instructional programs that derive their content from the tasks performed in each occupation/job and assess student performance on the basis of preset performance standards. Learning materials used in these programs identify, verify and publish in advance of instruction the job tasks (competencies) the student is to learn, the criteria by which the student will be evaluated, and the conditions under which the evaluation will occur. CBVE places emphasis on the ability to do, as well as on learning the how and why. Student performance and knowledge is individually evaluated against the stated criteria, rather than against group norms (Curriculum Terminology, 1982).

Computer-Assisted Instruction (CAI): The use of a computer in the actual instructional process. CAI is a medium of instruction that may be applied in any appropriate learning situation (Reynolds, 1983).

Computer-Based Learning (CBL): The "umbrella" word. CBL includes all of the activities described by the terms: CAI, CMI and CSLR (Reynolds, 1983).

Computer-managed Instruction (CMI): The management of instruction by computer. Management includes testing, prescription generation and record keeping (Reynolds, 1983).

Computer-Paced instruction (C-PI): This individualized pacing format uses student aptitude scores and instructional unit content to prescribe a time needed by each student to complete a unit of

instruction. For example, students with low math aptitude scores will be allowed more time on units with a high math content (Owens, 1987).

Computer-Supported Learning Resources (CSLR): The other supporting elements of CBL which neither directly teach as CAI, nor perform management functions. Usually limited to information storage, data bases retrieval and instructional communications (Reynolds, 1983).

Conventional Instruction (CI): The central features of CI include lock-step group instruction and lectures. Students are grouped according to academic aptitudes, and a single form of instructional material is used (Gagne and Briggs, 1988).

Group-Paced Instruction (G-PI): This individualized pacing format is based on mastery learning levels. Each student is expected to score at least ninety percent on each exam. In G-PI classrooms, less proficient students are expected to work on their own time, if needed to reach mastery level, so that the entire class can go on to the next unit of instruction together (Bloom, 1968).

Individualized Instruction (II): A term used to designate any instructional methodology or strategy which attempts to make a program responsive to the unique needs of individuals. May be operated as self-paced, teacher-paced, computer-paced or group-paced instruction (Finch and Crunkilton, 1989).

Individually-Paced Instruction (I-PI): The "umbrella" word that includes all of the activities described by the terms: computer-paced instruction, self-paced instruction and teacher-paced instruction (Pucel, 1989).

Instructional Technology: The study of the delivery of instructional materials to the student. It includes all instructional

design based on performance objectives, such as individually-paced instruction, mastery learning, computer-based learning, and interactive video (Pucel and Knaak, 1975).

Instructor Managed Instruction (IMI): A individualized instructional management system in which the instructor manually prescribes instructional materials. IMI may include the capability for record keeping, testing, media selection, and counseling. Sometimes used as a manual backup for CMI in case of computer failure (Wisneski, 1987).

Self-Paced Instruction (S-PI): This individualized pacing format allows students to progress through instructional programs at their own rates (Keller, 1968).

While not inherent in the definition, many assume the term "self-paced" instruction to include many of the other characteristics of individualized instruction. This study does not make that assumption.

Teacher-Paced Instruction (T-PI): In this individualized pacing format, the instructor uses aptitude exam scores and previous teaching experience to determine the time needed by each student to complete a unit of instruction (Kulik, 1978).

CHAPTER II

REVIEW OF LITERATURE

The review has been divided into three major areas: a discussion of competency-based vocational education, a discussion of instructional delivery systems, and a discussion of competency based vocational education and mastery learning as complementary or conflicting units of curriculum design.

Competency Based Vocational Education

In recent years, society has demanded accountability and excellence from the educational system at all levels, (Elias and Merriam, 1980). The philosophy expressed is that all who are involved with the educational process be held accountable for bringing about what education is designed to accomplish, Popham (1973) explained:

> The concept of educational accountability involves the teacher's producing evidence regarding the quality of his or her teaching, usually in terms of what happens to pupiles, then standing ready to be judged on the basis of the evidence. Any accountable teacher, therefore, takes responsibility for the results his or her instruction produces in learners (p. 41)

The demand for accountability is also heard from congress. The 1984 Carl D. Perkins Vocational Education Act mandated accountability. States like Arizona, Virginia, and Tennessee have enacted laws demanding accountability in the form of competency based education (Blank, 1987). Elias and Merriam (1980) define competency based education:

> Briefly, competency-based education (CBE) or competency-based instruction (CBI) is an educational program in which required performances are specified and agreed to in advance of instruction. CBE programs specify, in behavioral terms, the goals and objectives to be met, the learning experiences to be engaged in, and the method of evaluation used to demonstrate achievement of the predetermined goals. Implicit in such an approach is the behavioristic definition of learning as a change in behavior that can be observed and measured (p. 94).

Competency based vocational education (CBVE) differs from CBE only in subject matter and in methods of collecting instructional data.

The state of Virginia has taken CBVE one step further in requiring vocational education programs be based on competencies listed in the V-TECS and IDECC catalogs (Blank, 1987). Douglass and Patton (1988), in their discussion of technical committees and the Carl Perkins Act, said that most states use the Vocational Technical Education Consortium of States (V-TECS) catalogs as a source of competencies and DACUM (Develop a Curriculum) to verify these competencies. Douglass and Patton (1988) explained:

> Very little technical assistance was provided to the states from the federal level, so each state has interpreted the legislation in its own way and established committees and assigned duties according to its own resources and labor needs. Different states are using different designs for task list development. Some developed new lists, but most verified existing lists from sources such as V-TECS consortium products, task lists from state's curriculum development activities and other states' task listings. Primary methods of verification included surveys and structured group interviews. Primary development methods include DACUM and a combination of methods including surveys, job shadowing and interviewing (p. 29).

Develop a Curriculum

Develop a Curriculum (DACUM) was created as a joint effort of the Experimental Projects Branch, Canadian Department of Manpower and Immigration, and General Learning Corporation. The DACUM approach

relies on experts employed in the field to determine occupational curriculum content. Norton (1985) defined DACUM:

> DACUM or 'Developing A Curriculum' is a relatively new and innovative approach to occupational analysis. It has proven to be a very effective method of quickly determining, at relatively low cost, the tasks that must be performed by persons employed in a given job or occupational area.
>
> The detailed chart that results from the DACUM analysis is a detailed and graphic portrayal of the duties and tasks involved in the occupation or job being studied. The DACUM analysis can be used as a basis for (1) curriculum development, (2) student counseling and recruitment, (3) training needs assessments, (4) worker performance evaluation, (5) competency test development, and (6) job descriptions.
>
> DACUM has been successfully used to analyze occupations at the professional, technical, skilled, and semiskilled levels. DACUM operates on the following three premises:
>
> (1). Expert workers are better able to describe/define their job than anyone else.
>
> (2). Any job can be effectively and sufficiently described in terms of the tasks that successful workers in that occupation perform.
>
> (3). All tasks have direct implications for the knowledge and attitudes that workers must have in order to perform the tasks correctly.
>
> A carefully chosen group of eight to twelve expert workers from the occupational area under consideration form the DACUM committee. Committee members are recruited directly from business, industry, or the professions. The committee works under the guidance of a facilitator for two to three days to develop the DACUM chart. Modified small-group brainstorming techniques are used to obtain the collective expertise and consensus of the committee (p. 1).

Educational Consortium

Vocational Technical Education Consortium of States (V-TECS) is a collection of states joined together to develop CBVE. Full members are required to pay a set membership fee and contribute at least one CBVE product each year. These educational products are redistributed to member states, thereby, reducing the cost to each member state for

curriculum development (V-TECS, 1989). The mission statement for V-TECS (1989) is:

> The purpose of V-TECS is to promote the systematic development and implementation of the concept of competency-based vocational technical education by securing the active participation of state and vocational technical education agencies and other appropriate organizations which concentrate on (but are not limited to):
>
> -the analysis of jobs and the organization of job related information,
>
> -the development of vehicles for assessing student achievement,
>
> -the design, development and/or acquisition of instructional materials that provide a validated link between education and employment.
>
> An underlying premise of V-TECS is to provide and transport quality competency-based vocational technical education while conserving fiscal and human resources through shared development and diffusion (p. 2).

The Mid-America Vocational Curriculum Consortium (MAVCC) is similar to V-TECS in organization. However, MAVCC is drastically different in the CBVE products that it produces. MAVCC does not always use a task analysis to determine course content but instead relies on a curriculum committee of subject matter experts, similar to DACUM, to decide what task to use in a course of study. The task lists are not published for public use, however, a competency profile is available. The task, standards, and conditions for performance are used to generate performance objectives. A course of study is then designed around this group of performance objectives, the end product, of which, is a ready to use curriculum, commonly called the state curriculum (MAVCC, 1988).

The Pennsylvania Model for CBVE

The concept "CBVE" means different things to different people. Curriculum Terminology (1982) list eight different definitions for CBVE. Books on how to develop curriculum, such as, Pucel (1975), Perry (1982),

and Bradley (1987) present yet more definitions for CBVE. Buttram (1987) stated:

> Several authors have provided definitions of competency based vocational education (e.g., Spady, 1977; Knaak, 1977; Nickse and McClure, 1981; and Bell, 1980). These definitions usually list the desirable characteristics of competency based approach, such as, performance based, individually paced, responsive to individual needs, immediate feedback, task analyses, measurable objectives, criterion-referenced assessment, continuing program updates, input from the field, clear expectations, and credit for prior achievement (p. 2).

The state of Pennsylvania solved the problem of selecting from the many methods or models for developing CBVE. They opted for the generic approach and left the specific details of curriculum development to the school districts and teachers. Buttram (1987) stated:

> The move to CBVE began in Pennsylvania in the early 1970s, when educators became concerned about the quality of vocational curricula in the state. Many believed that vocational curricula were uncordinated and unrelated to the tasks and standards prevalent in industry. Others were concerned about duplication between secondary and post-secondary programs. CBVE was seen as a potential means for pulling the curricula together, changing instructional methods, and validating program content in an articulated way.
>
> Initially, the state's activities were a series of trial-and-error experimental efforts, the intent of which was the development of vocational curriculum models and materials. State officials began to change and mature in 1976 when they joined the Vocational Technical Educational Consortium of States (V-TECS). Members in V-TECS were provided resources that facilitated the development of competency based materials, up to then a difficult, time-consuming and costly process (p. 36).

The Pennsylvania CBVE model is a ten element list and, along with its sub-elements, include what the department of education determined was the minimum requirements for developing CBVE. The instrument used in the evaluation of CBVE in Pennsylvania was developed from this model.

The instrument was validated and used in 1985 and again in 1987 (Buttram, 1985). The Pennsylvania model:

I. Define Scope of Course

A. Major occupations are defined by D.O.T. code and title which the greatest number of recent graduates have been employed during the past 3 years.

B. Employment opportunities for defined occupations are projected for 3-5 years from labor market data and advisory committee feedback.

C. Anticipated technological changes in defined occupations are determined from industry and advisory committee feedback.

D. Course description written for assigned VEMIS title based upon D.O.T. occupations and verified by advisory committee.

II. Validate Occupational Competencies

A. V-TECS task lists are reviewed by instructors to identify tasks for defined occupations.

B. Other task lists reviewed by instructor to identify additional tasks for defined occupation.

C. Task lists created for defined occupations where none are currently available.

D. Occupational tasks for defined occupations approved and documented by advisory committee based upon industry needs.

III. Identify Valid Terminal Performance Objectives for Each Task.

A. Performance objectives from appropriate V-TECS catalog(s) identified and reviewed.

B. Performance objectives from other sources identified and reviewed.

C. Performance objectives written for tasks where none are currently available.

D. Performance objectives content reviewed with advisory committee to determine validity of conditions, performance, and standards.

IV. Identify Sequential Performance Steps for Each Task.

A. Performance guides in V-TECS catalog(s) reviewed for content and sequence.

B. Performance steps identified and reviewed for content and sequence for tasks not identified in V-TECS catalog.

C. Performance steps written and sequenced for tasks where none are currently available.

D. Performance guide content and sequence for all identified tasks approved and documented by advisory committee.

V. Determine Resources Required to Perform Tasks

A. V-TECS tool and equipment list analyzed for application to task performance.

B. Additional tools and equipment identified for tasks.

C. Facility and/or environmental requirements identified and documented.

D. Reference materials identified for each task.

E. Finalized resource list reviewed and documented by advisory committee.

VI. Determine Required Task Sequence

A. Review performance guides to identify prerequisite tasks.

VII. Assess Student Performance for Each Objective

A. Performance tests constructed for each objective based upon established standards.

B. A system to convert performance on objectives to a conventional grading scale (if required) is in place and known to students.

VIII. Identify Instructional Program Contents for each Student

A. Tentative career objective identified and documented for each student.

B. Task list delineated and reviewed with each student for occupation in career objective.

C. Student entry level skills assessed to determine initial instructional placement in program.

D. Task list converted to an individual program for each student.

IX. Design a Learning Management System

A. System developed to monitor student progress.

B. System provides for continuous feedback to the student.

X. Conduct Course Evaluation

A. Student completion and follow-up data compiled for course revision.

B. On-the-job performance of graduates assessed through employer feedback via local surveys.

C. Industry data obtained and used to determine future applicability of course content.

D. Feedback information used to periodically recycle instructor(s) through CBVE implementation process (p. 35).

The initial evaluation of CBVE in Pennsylvania was completed in 1985 with a more extensive evaluation completed in 1987. The purpose of these evaluations was to determine the extent to which CBVE had been implemented. Buttram (1987) stated:

> In this paper, an evaluation study of competency based vocational (CBVE) in Pennsylvania is presented. Data were gathered via interviews with 19 key state education officials and representatives from 75 educational agencies, including area vocational technical schools, community colleges, and high schools. Additionally, 348 randomly selected teachers from 28 schools completed surveys regarding level of CBVE implementation. This result showed the highest levels of implementation in the vocational schools, especially in areas related to curriculum development. Receiving state support for the local curriculum development enabled coordinators to increase the level of implementation significantly. As expected, administrators within the schools facilitated implementation. Conversely, insufficient development time and resources were hindrances to implementation (p. 35).

The extent of CBVE implementation in the state of Pennsylvania as rated by the administrators was 3.07 overall on a four point scale. The extent of implementation as rated by the instructors was 3.01 overall on all elements of the state model.

The Pennsylvania model is a popular, well-accepted instructional approach for developing CBVE. The only glaring omission is that little is said about how to deliver CBVE instruction. The problem with instructional delivery systems, however, existed well before the Pennsylvania model was developed. Pucel (1987) explained:

> In 1975, Pucel and Knaak wrote the book 'Individualizing Vocational and Technical Instruction'. In that book they brought together the concepts of mastery learning as proposed by John B. Carroll (1963), the systems approach, and criterion evaluation as proposed by Popham and others (1971). The results was a systematic approach for designing, delivering and evaluating individualized instruction focused on task mastery. The book was based on five years of curriculum model development and experimentation at the 916 Area Vocational Technical Institute at White Bear Lake, Minnesota. It provided detailed information on how to analyze content using task analysis, the logic of mastery learning applied to vocational education, techniques for developing individualized learning materials, and detailed procedures for developing criterion tests (including manipulative performance and product evaluation). However, it, as other books of its time did not spend a great deal of time on how instruction should be structured for actual presentation and delivery to learners (p. 7).

Pucel (1987) goes on to state that present day designs for CBVE still are lacking in the vital area of instructional delivery. He stated:

> . . . CBVE again concentrates on the psychomotor aspects of an occupation as the primary focus of analysis, and therefore, instruction. Little is said about how to deliver the instruction; in fact instructional design for delivery is viewed as being of minimal concern (p. 8).

The next section of the review of literature will concentrate on instructional delivery systems. The delivery systems selected for study

must meet one or more of the following criteria, be: performance based, individually paced, responsive to individual needs, have provisions for immediate feedback with correction, criterion-referenced assessment, and mastery learning.

Instructional Delivery Systems

With the invention or development of tools and language came the need for education and training. For much of early history, schooling meant individualized teaching. Finch and Crunkilton (1989) stated:

> Individualizing instruction has been a concern of educators for a number of years, perhaps beginning in the minds of early teacher-philosophers such as Plato and Aristotle. These scholars, as well as Rousseau, Froebel, and others, relate to the needs of the individual within the instructional process (p. 244).

The Greeks and Romans founded the first academies, where pupils were taught individually by tutors. The Socrates method included short organized units of instruction directed toward specific objectives and tailored to an individual student's interest and abilities. Aristotle had a similar system of teaching and also viewed learning as an individual process based on objectives and a structured environment (Knirk and Gustafson, 1986).

In America, students continued to be taught individually until the middle of the nineteenth century. Children of different ages met in one-room schools with a single teacher. They progressed at their own rates through the instructional materials available. However, with the establishment of the first grade level school at Boston in 1848, a change in the instructional organization of schools began. The administrative and economic efficiency of organization by grade level

was so great that by 1860 virtually all individualized teaching had vanished (OTTO, 1950).

Leading educators of the time, however, recognized the defects in the grade level system and proposed many grouping plans to solve the problem of teaching to student individual differences. The plans proposed attempted to teach students individually in a grouped environment. Some of the many plans proposed were:

- St Louis Plan (1857): This plan required students to satisfactorily complete a ten-week quarter of instruction before being promoted to the next quarter. Graduation from one grade-level to the next was only after four quarters had been completed

- Pueblo Plan (1888): This plan was completely individually-paced. Students progressed at their own pace until all requirements for a grade-level was satisfactorily completed, before promotion to the next grade-level.

- Cambridge Plan (1893): This plan divided students into groups by aptitude. The last six grade-levels were arranged in two parallel courses, the regular course which required six years to complete and a special course for brighter students which could be completed in four years.

- Platoon Plan (1908): This plan divided students into groups, called platoons. Each platoon was provided a schedule of classes arranged for that platoon.

- Portland Plan (1910): This plan also divided students into groups by aptitude, with the more capable students being placed in a separate division.

- Batavia Plan (1910): This plan made special provisions for slow-learning students. Each room had two teachers, one a regular teacher, the other an assistant who coached laggards at a desk at the rear of the room.

- North Denver Plan (1910): This plan made special provisions for the bright student. All pupils covered the minimum assignments, with enriched assignments on each topic for the brighter students.

- Santa Barbara Plan (1910): This plan divided students into groups by aptitude. All students completed the "C" level requirements. The brighter students also completed the "B" level requirements, with the brightest students also completing the "A" level requirements.

- Winnetka Plan (1913): This plan divided a course of study in two parts, the "common essentials", and the "group and creative activities". Classes were taught using specially prepared individual-progress materials for each class session. Students who mastered the common essentials were allowed to participate in the group and creative activities.

- Dalton Plan (1919): This plan allowed for individual student progress in academic subjects only, other subjects were taught in regular class sessions. A student contracted for grade and was allowed one month to complete that unit of instruction, before proceeding on to the next unit.

The many attempts at converting schools to individualized instruction failed because the administrative and economic efficiency of grade level organizations were so great that it over shadowed any needs of the individual student. However, with the advances in technology in

recent years this factor is changing. Knirk and Gustafson (1986) explain:

> While economic factors and the shortage of trained teachers once forced abandonment of one-to-one or one-to-a-few instruction in favor of group instruction, advancements in instructional technology are now permitting a return to individualized instruction. The preparation of evaluated and revised instructional materials is initially expensive, but replication of that design for many learners can reduce the cost of individualized instruction or communication to a level comparable with group instruction (p. 4).

Educational systems today are expected to provide students with salable skills that meet the demands of a modern highly technical society. To meet these needs, new and more demands are being forced on the educational system, both in terms of desirable ends and a means to arrive at the end (Peters, 1987). Pucel and Knaak (1975, p. 24) stated: "Students have different interests, learn at different rates of speed, and learn using different methods. The meeting of these individual needs requires individualized instruction".

The mission of vocational education is to assist individuals with the development of skills and knowledge required to succeed in an occupation. The job of an educator then is to select an instructional model that best meet the needs of the student. The selected model must deliver the course content, determined by a task analysis, at a level of proficiency required by the occupation. The selected model must also provide enough time for each student to master each task at that proficiency level (Pucel and Knaak, 1975).

Instructional Models

It is possible to organize an instructional program using seven of the eight models listed below. These models are made up of all possible

combinations of content, time, and proficiency levels. Content refers to the amount of instructional materials that are presented to students during a course of instruction. Time refers to the length of time each student is given to complete a unit of instruction or to complete all tasks in the course. Proficiency level refers to the skill level each student is expected to achieve for each unit of instruction (see Figure 1, p. 22).

The first model is not practical as it makes no provisions for student individual differences which are always present. The second model is used in conventional lock-step instruction and features a fixed content and a fixed semester of time. Individual differences in this second model are accounted for by allowing students to vary in skill level according to their own learning speed and abilities. Grades A, B, C, D, and F reflect this skill level achievement. Models three through eight are feasible individualized instruction models. Models three, five, and seven are mastery learning models because they feature the fixed proficiency levels necessary for mastery learning. Model three is the most desirable model for individually-paced instruction. This model allows for a fixed amount of instructional materials at a fixed level of mastery required by an occupation and also allows each student enough time to develop skill levels necessary to meet the demands of their chosen profession. Model five is used in group-paced individualized programs. Group-paced systems are mastery level semester programs with a fixed-time and a fixed-proficiency level. Content is allowed to vary with student learning speed and abilities and thus accounts for individual differences. Variable content is not a problem as long as the slowest learner can meet the minimum or core requirements of the

Model Not Feasible

1. Fixed-content, Fixed-time, Fixed-proficiency

Traditional Model

2. Fixed-content, Fixed-time, Variable-proficiency

Individualized Models

3. Fixed-content Variable-time, Fixed-proficiency

4. Fixed-content, Variable-time, Variable-proficiency

5. Variable-content, Fixed-time, Fixed-proficiency

6. Variable-content, Fixed-time, Variable-proficiency

7. Variable-content, Variable-time, Fixed-proficiency

8. Variable-content, Variable-time, Variable-proficiency

Figure 1. Instructional Models

Pucel, D. J., Knaak, W. C. (1975). Individualizing Vocational and Technical Instruction. Columbus, Ohio: Merrill.

course. Models four, six, seven, and eight are not normally used in instructional design (Pucel and Knaak, 1975).

Individualized Instruction

If individualized instruction allows for instructional design that can accommodate student individual differences and also provides for mastery learning, then it is not surprising that most authors of CBVE development methods recommend individualized instruction. Finch and Crunkilton (1989) explain:

> Since CBE is inherently geared toward meeting students' needs, it comes as no surprise that most competency-based curricula are also individualized. This can be most readily evidenced by the instructor's basic commitment to aid each student's attaining mastery of specified competencies. However, it should be remembered that individualized and competency-based education are not synonymous. One could develop an excellent individualized program focusing on the development of drama appreciation that might not assist a student in building competence needed for employability in a particular occupation or occupational area.
> Individualization, then, is seen as a means of enhancing competency-based instruction so there may be greater assurances of meeting students' individual needs and providing learning experiences that align with personal capabilities. By making a commitment to individualizing instruction, the teacher is saying that he or she will provide whatever arrangements are necessary to ensure that each student will be constantly engaged in learning those things that are greatest value to himself or herself. This is what makes individualization a most meaningful contributor to the goals of CBE (p. 244).

If individualized instruction (II) is such an integral part of CBVE, what then is II? Individualized instruction is a term used to designate any instructional methodology or strategy which attempts to make a program responsive to individual differences. It is also any instructional delivery system (Bangert, 1983 and Bond, 1985) in which students work through carefully designed course materials that typically feature:

- Division of work into units
- Characteristics of unit mastery
- Use of study guides and objectives
- Diagnostic testing
- Responsive to individual needs
- Immediate and specific feedback at every step
- A variety of pacing formats

The popularity of the various individualized systems is a unique feature in the study of instructional design. There are as many individualized systems of instruction as there are authors to write about them, there is also a wide difference in the utilization of these systems.

Individually Prescribed Instruction (IPI) was developed in 1964 by Glaser and Bolvin (Thomas, 1985) at the Learning Research and Development Center at the University of Pittsburgh. The United States Office of Education, Research for Better Schools was the principle developer of public school IPI materials. It is reported that over 100 schools nationwide are using IPI. Individually Guided Education (IGE) was developed in 1966 by Klausmeier at the University of Wisconsin's Research and Development Center for Cognitive Learning. IGE is reported to be used in over 3000 elementary and middle schools in the United States. Programmed For Learning in Accordance With Needs (PLAN) was developed in 1971 by Flabagan under a joint project of the American Institutes for Research and the Westinghouse Learning Corporation. PLAN, IGE, and IPI follow a basic diagnostic prescriptive teaching cycle and are used extensively at the elementary and secondary levels but have a low usage at the post-secondary level.

Audio-Tutorial was developed by Postlethwait in 1961 (Thomas, 1985) as a remedial instruction program for a botany course at Purdue University. Audio-Tutorial has a moderate usage at the post-secondary level only. Programmed Instruction and Computer Aided Instruction both had their beginning as part of Skinner's teaching machine projects in 1954. Programmed instruction and computer based learning have world wide usage.

The two most popular systems are Learning For Mastery (LFM) and Personalized System of Instruction (PSI). LFM was developed in 1968 by Bloom at the University of California at Los Angles. LFM is featured in over 5000 research articles and it is found in over 20 countries. PSI was developed in 1964 by Keller at the University of Brasilia in Brazil. PSI is featured in over 3000 research articles and over 300 long term research projects (Kulik, Kulik, & Cohen, 1979). For example, PSI has been used continuously for 19 years in the engineering department at the University of Texas at Austin (Koen, Jensen, & Roth, 1985).

There is also the problem of selecting the correct delivery system to match the situation as Thomas (1985) explains:

> An important conclusion drawn from studies in this field is that no single technique for individualizing instruction is appropriate in all situations. Which technique will succeed best depends on the combination of variables affecting learning in that setting. Among the most influential variables are: the type of goals being pursued, the learners' levels of ability, the number of students being instructed by a single teacher, the type and amount of equipment available, the teacher's skills and personal style, and the breadth of individual differences among the learners in the group. As a consequence, if educators are to select suitable methods of individualization for a given setting, they need to know a range of methods and the advantages and disadvantages of each (p. 2446).

Models of Instructional Delivery Systems

There are many models of instructional delivery systems. The six listed below make up the bulk of available literature for review at the secondary and post-secondary levels:

- Programmed Instruction (PI)
- Audio-Tutorial (A-T)
- Job-Specific Instruction (J-SI)
- Computer Based Learning (CBL)
- Learning For Mastery (LFM)
- Personalized System of Instruction (PSI)

Programmed Instruction. Programmed Instruction (PI) was developed by Skinner in 1954. There are three basic steps to developing PI. First, suitable written instructional materials are selected. Next, these materials are divided into small sections, usually a sentence and no more than a paragraph. These small divisions, called frames, are blocked off on paper or put into a teaching machine. Frames also contain an active response, usually a question or problem to solve that the reader must answer. Last, the sequencing of the materials allows for a correct answer, usually at the top of the next frame. This correct response allows the reader to grade their response, thus providing corrective and immediate feedback. The two sequencing methods or formats for these frames are linear and branching. In the linear method, students move forward frame after frame until completion. In branching, incorrect answers require the student to jump back to a remedial section and then return upon completion of the remedial. PI uses both teaching machines and programmed instruction booklets. The

one big difference between PI and other delivery systems is that PI does not require the use of objectives (Skinner, 1968).

Audio-Tutorial. The Audio-Tutorial (A-T) was developed by Postlethwait at Purdue University in 1961. A-T is an instructional delivery system with no provisions to develop curriculum. Existing instructional materials, objectives, and instructor made audio tapes are main features of this system. A typical A-T learning center has several study carrels, each equipped with an audio tape machine, a set of objectives, illustrated materials, laboratory manuals, and other audio-visual materials as necessary. Individual guidance is provided via taped instructions that serve as a study guide rather than a lecture. The tapes provide a logical sequence for studying the materials provided in each carrel. In addition to the learning center sessions, there are weekly class meeting for lectures, group films, examinations, and other group activities. Self-pacing can occur on a limited basis but is not a main feature. The one big difference between audio-tutorial and other systems is that it does not require unit mastery (Bond, 1985, p. 2453).

Job-Specific Instruction. Job-specific instruction (J-SI) is primarily a military curriculum development system with provisions to provide individually-paced instruction. The individualized delivery system is an open-entry open-exit system that uses computer-paced and self-paced instruction (Owens, 1987). Computer-paced instruction uses the Armed Forces Vocational Aptitude Battery (ASVAB) exam scores and unit content data to compute a specific time each student is allowed to study a particular unit of instruction. For example, if a student has a

low math score and a unit has above average amounts of math then the student is given more time to complete that unit. Each unit time for each student is computed using the appropriate aptitude scores for the course being taught. J-SI was developed by the US Navy and follows the military guidelines of Instructional Systems Development NAVEDTRA 106A (Wisniewski, 1987).

Instructional Systems Development. The Instructional Systems Development (ISD) is the most accepted approach for the design of training materials in the Armed Services. Specifically, ISD is used in the United States Air Force, Army, and Navy. The five phases of ISD are: analyze, design, develop, implement, and control (see Figure 2, p. 29). ISD procedures are characterized by a detailed selection of training requirements from a job/task analysis, the selection of instructional strategies to maximize learning, and an extensive use of computer based learning. The instructional delivery system for ISD follows the guidelines listed below:

1. inform the students of the objectives
2. provide for interactive response
3. provide for guidance and prompts
4. provide for feedback (Finch & Falls, 1982, p. 63)

Finch (1982), in an article on Trade and Industrial Education sums up his research on systems development in the armed forces when he stated:

> Military technical training research exemplifies the type of programmatic inquiry that should take place in all of education. Results of systematic research efforts conducted over the past decade are clearly linked to improvements in the training environment (p. 1943).

The Instructional Systems Development Model

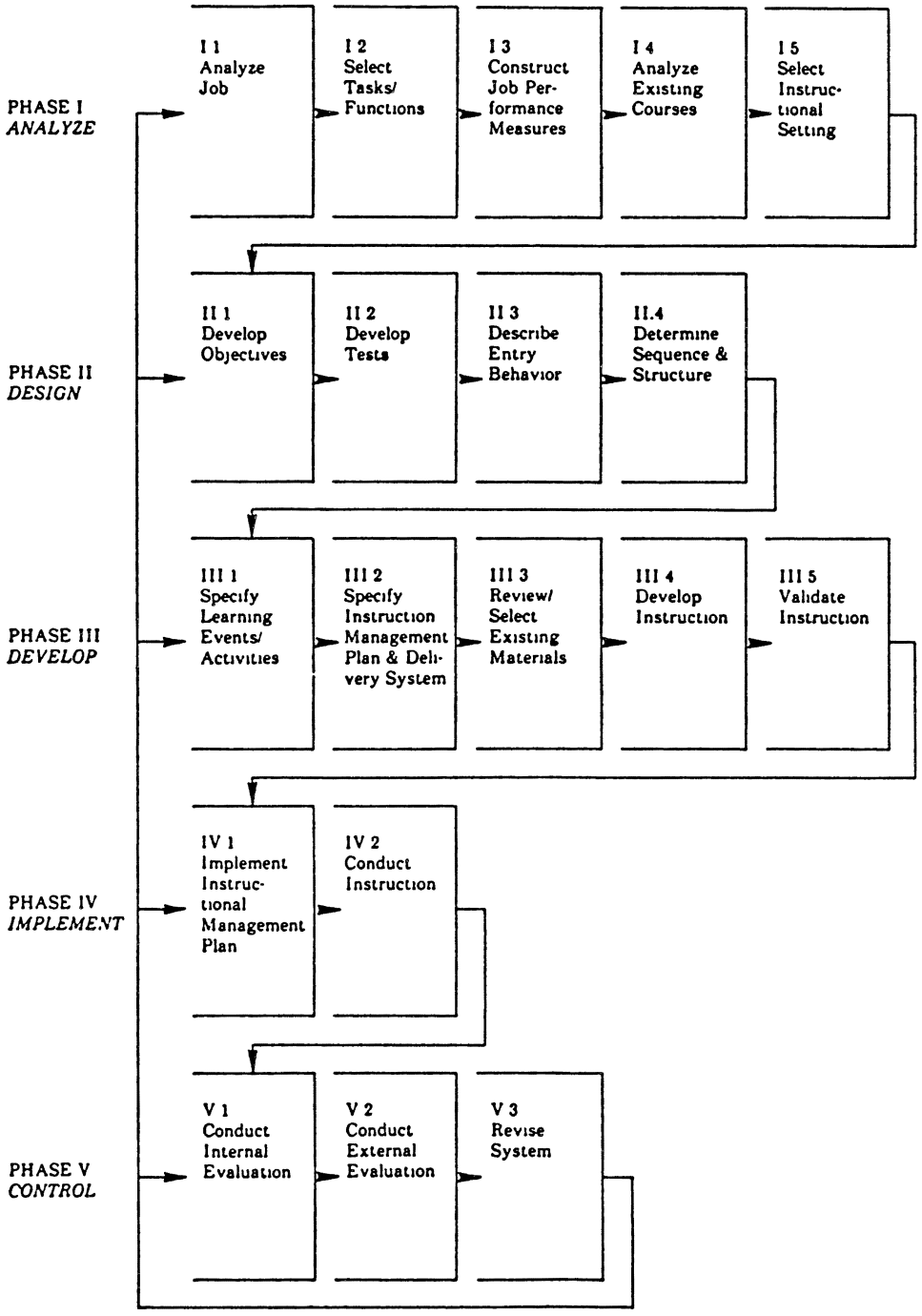


Figure 2 The Instructional Systems Development Model

NAVEDTRA 106A. (1975). Interservice Procedures for Instructional Systems Development.

Suzuki (1987) had this to say about the systems approach to vocational curriculum design:

> Although systems approaches to instruction share much of the same heritage as vocational and technical education, they appear to serve as alternatives to traditional instruction rather than as a single delivery mode. Systems have the potential to make significant impact on vocational and technical instruction. However, they still appear to be a potential force instead of a reality. Perhaps as vocational and technical professionals begin to develop a better understanding of systems approaches and apply them in realistic settings with the help and support of experienced persons, they will appreciate the potential that really exists (p.55).

Computer Based Learning. Computer Based Learning (CBL) is a growing phenomenon, both in importance and interest. It is now considered by many as a separate and distinct form of learning. CBL by its very nature is a system of individualized instruction. Most computer systems and programs are designed to serve only one student at a time, however, almost any style of learning can benefit (Reynolds, 1983).

The computer revolution in teaching can be traced back to B.F. Skinner, programmed instruction, and his teaching machines. Computers due to their extraordinary flexibility can be adapted to any individualized learning model described in this paper and often are. The components of computer based instruction according to Reynolds (1983), are CAI, CMI and CSLR as follows:

Modes of Computer-Assisted Instruction (CAI)
- -Tutorial
- -Drill and Practice
- -Instructional Games
- -Modeling
- -Simulation
- -Problem Solving
- -Computer-Enriched Instruction

Modes of Computer-Managed Instruction (CMI)
- -Testing

-Prescription Generation
-Record Keeping

Computer-Supported Learning Resources (CSLR)
-Information Storage and Retrieval
-Instructional Communication

In Computer Assisted Instruction, computers can talk, direct, teach or present learning materials but, as of yet, are not fully capable of listening to students. The computer can also control other learning devices, such as VCR's, audio units, sound-slide, or any combination of equipment (Interactive Video, 1989). The possibilities of CAI are limitless. The one area of intense study is computer technology and programmed instruction. Kulik (1985c) explained:

> In early applications, the computer simply delivered programmed instruction and managed individualized teaching systems. The marriage of computer technology and programmed instruction came to be known as computer-assisted instruction (CAI); the marriage of computer technology and individualized systems produced computer-managed instruction (CMI). More recently, computers have been used for more sophisticated teaching jobs. They have served as tools in mathematics and writing classes and as simulation devices in classes in the natural and social sciences. Some educators now argue that students learn most from computers when they are used in this way to provide computer-enriched instruction (CEI) (p.3).

Paper copies of programmed instruction (PI) are often used as a manual backup on days the computer systems are down.

In computer managed instruction (CMI), computers are taking all the work out of managing instructions. They can schedule test, take roll, compute grades, make homework assignments, diagnose student weaknesses, direct students toward other appropriate learning resource materials, and do almost any type of record keeping duties (Reynolds, 1983).

Learning For Mastery. Learning For Mastery (LFM) is a group-paced individualized delivery system with no provisions to develop curriculum.

Instructional materials and objectives are adapted from other sources. LFM was first published by Bloom in 1968 at the University of California at Los Angles. Bloom adapted his theory of learning from Carroll (1963).

LFM's central learning theory as explained by Gagne (1988) is:

> Mastery learning means essentially that if the proper conditions can be provided, perhaps 90 to 95 percent of the students can actually master most objectives to the degree now only reached by "good students." Thus the mastery learning concept abandons the idea that students merely learn more or less well. Rather, an effort is made to find out why students fail to reach mastery, and remedy the situation for each student. The resolution of a learning problem by a student usually requires one of the following measures: (1) more time for learning, (2) different media or materials, or (3) diagnosis to determine what missing prerequisite knowledge or skills he must acquire to master the objective (p. 247).

Unlike other individualized teaching models, LFM can be used in conventional classrooms that are restricted to fixed periods of time. LFM requires the instructional units be small and manageable; it also requires the use of objectives. Self-pacing, teacher-pacing or computer-paced systems are optional. LFM uses summative and formative testing as central features. Formative testing is used with the instructional units to determine mastery levels and to provide feedback-corrective information. The corrective procedure consist of the teacher/reteaching the portions of the unit the majority of students missed. Other students who fail to reach mastery are given extra help in the form of study groups, tutoring, alternate instructional units, and selected audiovisual materials. Students are expected to complete these remedial studies in a timely manner so that the entire class can go on to the next unit of instruction together. Students who reach mastery level early are given enrichment materials. Summative testing

is used to determine grades and as an assessment of learning for the entire course or a substantial part of it (Bloom, 1968).

Personalized System of Instruction. The Keller plan is entitled Personalized System of Instruction (PSI). PSI is both a instructional delivery system and a system for managing curriculum. Keller's PSI feature:

(1) unit mastery requirements

(2) various pacing formats

(3) reliance on individual instructional materials, usually written

(4) occasional lectures and demonstrations to motivate students

(5) student proctors are used for repeat testing, immediate scoring, tutoring, and to provide continuing personal and social interaction.

In PSI course development, instructional materials or units are in a linear sequence, and students are expected to master each unit before proceeding to the next. Student individual differences determines how much study time is required for each unit. A study guide is prepared for each unit and includes the performance objective and specific unit objectives. Instructional materials for each unit are multimedia and allow for selection from existing books, articles, tape-slide materials or any available instructional materials. Several parallel forms of the unit test are prepared to measure student mastery levels of unit objectives. Proctors are required to determine whether students have achieved mastery of the unit objectives, to provide students with immediate feedback on test results, and to assign any remedial studies that might be necessary. Once students have completed the remedial studies, they may take an alternate form of the original unit test to

determine mastery and if successful are allowed to proceed to the next unit of instruction (Melton, 1981, p. 405).

The main characteristics of the instructional delivery system for PSI are:

(a) small steps and frequent testing.

(b) immediate and specific feedback at each step.

(c) study guides and objectives.

(d) a requirement of mastery at each step.

Unit size is short and usually takes no more than three to five hours of class time and from two to ten hours out of class study time to complete. The rational here is that student study time is more evenly distributed over the term. With shorter units and more quizzes, students are less likely to cram. Short units also allow for frequent feedback and a more efficient way of correcting errors (Bond, 1985).

Study guides and objectives provide a method of course management. Review units are also used and spaced every two to eight units of instruction. These review units are designed to reinforce what students have learned, to provide an overview, and a way to relate materials to other parts of the course (Bond, 1985).

In mastery learning, students are required to reach a predetermined level of achievement. PSI uses criterion-referenced testing, usually set at 90 percent or better, as a means of determining unit mastery. Remedial study is required for students who fail to reach unit mastery levels. Students are not allowed to proceed to another unit until mastery is reached.

Meta-Analysis in Research

The volume of scientific literature is growing each year. For example, there was only one scientific journal published in 1665 compared to an estimated 1,000,000 journals by the year 2000. A researcher would have to double and re-double the volume of research materials read each year to keep up with the current state of knowledge in their interest area. To alleviate this problem, Glass (1976), with the aid of some very sophisticated computer systems and in-depth statistical programs, developed a method of handling or condensing large volumes of research data. He titled his method meta-analysis or analysis of analysis. Meta-analysis is a statistical analysis of a large collection of individual studies on a specific subject for the purpose of integrating findings. The most used feature in meta-analysis is effective size (ES). Borg and Gall (1983) explain:

> In recent years, the meta-analysis approach developed by Gene Glass and his colleagues has been widely adopted by researchers. This method involves converting the findings of each study to an effective size. For studies that compare an experimental and control group, the effective size is computed by subtracting the mean score of the control group on the dependent variable from the experimental group mean and dividing by the control group standard deviation. Similar formulas have been developed to convert most inferential statistics, such as t-ratios, f-ratios, percentages, and correlation coefficients to an effective size. The mean of the effective sizes for all studies included in the research review is then calculated to estimate the typical effect of the phenomenon under study (p. 197).

To interpret, ES found in a study a positive (+) ES means the meta-analysis results favored the experimental group. A negative (-) ES means the results favored the control group. The absolute number indicates the magnitude of the results in standard deviations (Borg, 1983).

Meta-analysis use since 1982, has grown very rapidly, especially in the social sciences and education. It is a superior system as compared to any other integration of research findings. Yet despite all this, meta-analysis does have some minor limitations and each user should study a particular meta-analysis before using the information provided (McGaw, 1985). Borg (1983, p. 197) stated: "Despite the limitations of meta-analysis, it is currently the best available method for cumulating and integrating the results of research".

Thompson (1985) after three years use stated:

> Meta-analysis (Glass, 1976) is a method for synthesizing a collection of research studies. The technique is an extremely powerful and sensitive statistical tool, and brings findings from many studies into sharp focus, It permits overall analysis of effectiveness and of the sizes of the effect produced, as well as detailed component analysis of the variables responsible for the effects obtained (p. 11).

Research and Post-High Students

A series of extensive Meta-Analysis were performed by Kulik and Associates (1979, 1980, 1982, 1984, 1985, and 1986) on individualized versus conventional instruction at the post-high level. A total of 333 studies were condensed to authoritative summaries. These studies centered on five basic methods of instructions as follows:

1. Programmed Instruction (PI)
2. Audio-Tutorial (A-T)
3. Computer Based Learning (CBL)
4. Learning For Mastery (LFM)
5. Personalized System of Instruction (PSI)

Programmed Instruction. A Meta-Analysis was carried out on Programmed Instruction (PI) (1980a) by Kulik, Cohen and Ebeling. A pool of 5,000 research studies were examined and 57 high quality studies were selected for the analysis. The studies selected were a comparison of Programmed Instruction (PI) to Conventional Instruction (CI). The instructional outcome most often reported was student achievement on final examinations.

The Meta-Analysis indicated that 55 percent of selected post-high studies reported no significant difference between PI and CI. The results of this meta-analysis was in agreement with results reported in other reviews of research on Programmed Instruction (Kulik, 1980a). However, the remaining studies favored PI over CI. The effective size (ES) for all studies combined was 0.28 SD in favor of PI. Overall a typical student in a PI class performed at the 60th percentile mark as compared to the 50th percentile mark for a typical CI student (see Table I). This is a modest improvement and the two systems were considered equal in effectiveness. In the selected studies students were ask to rate their course on four major aspects as follows:

-Overall Quality

-Overall Learning

-Overall Enjoyment

-Amount of Work

In three areas CI and PI were rated equal with no more than three percentage points separating any score. The only difference was in the amount of work. Students in PI classes used five hours of study time per week as compared to 6 hours for CI students (Kulik, 1981).

TABLE I

SUMMARY OF RESULTS OF A META-ANALYSES OF RESEARCH ON INSTRUCTIONAL TECHNOLOGY IN HIGHER EDUCATION

	Student Achievement										
	N	Exam Scores	Percentile Rank	N	Student Satisfaction (5-Point Scale)	N	Withdrawal Rate	N	Time Taken (Hrs/Week)	N	Aptitude Achievement Correlation
Audio-Tutorials	42	68.5%	58	6	3.56	22	19%	—	—	12	.36
Conventional Instruction		66.9%	50		3.30		17%		—		.39
Significance level		$p < .05$	—		*N.S.*		*N.S.*				*N.S.*
Mean effect size		.20	—		.12		0.06		—		.02
Computer-Based teaching	54	60.6%	60	11	3.77	13	26.9%	8	2.25	7	.41
Conventional Instruction		57.6%	50		3.50		27.6%		3.50		.51
Significance level		$p < .01$	—		—		*N.S.*		$p < .01$		*N.S.*
Mean effect size		.25	—		.24		−.01		—		.12
Keller Plan Instruction	61	73.6%	70	11	4.19	27	13.9%	4		9	.50
Conventional Instruction		65.9%	50		3.40		12.6%		Approx. equal		.50
Significance level		$p < .0001$	—		$p < .01$		*N.S.*		—		*N.S.*
Mean effect size		.49	—		.46		.10		—		0
Programmed Instruction	56	67.1%	60	4	3.41	9	20.3%	9	5	19	.40
Conventional Instruction		64.8%	50		3.49		19.7%		6		.48
Significance level		$p < .05$	—		*N.S.*		*N.S.*		*N.S.*		*N.S.*
Mean effect size		.28	—		−.10		.06		—		.09
Visual-Based Instruction	65	68.4%	56	16	3.45	10	13.1%	—	—	16	.50
Conventional Instruction		66.9%	50		3.48		13.2%		—		.45
Significance level		$p < .01$	—		—		*N.S.*		—		*N.S.*
Mean effect size		.15	—		−.06		−.05		—		.06

Note. A dash indicates that the information was not available. "N.S." means not statistically significant at the .05 level.

Dunkin, M., Barnes, J. (1986). Research on Teaching in Higher Education. In Whittrock, M. C., (ed). Handbook of Research on teaching, (3rd ed). p. 758). New York: McMillian

The one variation to this meta-analysis was the research projects performed in the late 1970's as compared to earlier works. Programmed Instruction had performed very poorly in the 1960's but showed much improvement in later studies. Kulik (1986) attributes the improved record to improved PI materials and improved use of PI. He states that instructors had learned what PI could and could-not do. The meta-analysis, listed above, was restricted to written forms of PI. It did not include any derivations of PI such as Computer Based Learning.

Audio-Tutorial. A meta-analysis was performed on 48 studies comparing Audio-Tutorial (A-T) with Conventional Instruction (CI). The analysis found that A-T had a significant but small overall effect on student achievement as indicated by final examination scores. A-T students ranked at the 58th percentile mark as compared to a 50th percentile mark for CI students. On a five point student satisfaction scale A-T received 3.56 points on the average as compared to 3.30 points for CI. Dropout rates for A-T and CI were 19 percent and 17 percent respectfully (see Table I). Overall, the 48 studies indicated A-T and CI to be approximately equal in all aspects studied (Kulik, 1979b).

Computer Based Learning. A meta-analysis was performed on Computer Based Learning (CBL) as compared to conventional instruction (CI) at the elementary, high-school, college, and non-traditional post secondary levels. A total of 199 studies were included and summarized in Table I (Dunkin, 1986).

At the post-high level, a total of 101 studies were used in the meta-analysis. The outcome most often measured was student learning as

indicated by scores on examinations given at the end of a course of instruction. Other outcome variables measured were:

a) performance on follow-up or retention examinations given some time after program completion,

b) attitude toward computers,

c) attitude toward mode of instruction

d) course completion, and

e) amount of time needed for instruction.

Ninety-nine of the 101 studies reported results on final examinations. In 77 of the 99 studies, CBL reported higher examination scores. In 22 studies, conventional classes reported higher scores with only one study indicating a statistically significant difference favoring conventional instruction. Twenty-one studies reported a statistically significant difference favoring CBL (see Table I). Kulik (1985c) summed it up this way:

> The index ES provides a more exact picture of the degree of benefit from CBE in the typical study. The average ES in the 99 studies was 0.26; its standard error was 0.051. This average ES means that in the typical study, the performance of CBE students was 0.26 standard deviations higher than the performance of the control students. ESs can also be expressed in terms of percentile scores. Approximately 60% of the area of the standard normal curve falls below a z-score of 0.26. We can conclude, therefore, that the typical student in an average CBE class would perform at the 60th percentile on an achievement examination, whereas the typical student in a conventionally taught class would perform at the 50th percentile on the same examination. Put in another way, the average student from CBE class would out perform 60% of the students from the conventional classes (p. 9).

The results of the meta-analysis on 18 studies for adult students indicate a similar positive results for CBL. In the two studies reporting computer enriched instruction, adult students indicated a superior rating.

The only area CBL indicated a negative effect was in course completion. A total of 21 studies reported higher completion rates for CBL classes. However, 13 studies reported higher completion rates for conventional classes. The overall "effect size" (ES) for post-high students was -0.06 SD. Only two studies reported completion rates for adult students with ES scores of 0.27 and 0.08 standard deviations (Kulik, 1985c).

The one outstanding feature of CBL was the use of instruction time. Fifteen studies reported instruction time for post-high students. The average time for completion was 0.66. In other words, CBL students could complete a unit of instruction in two-thirds the time required of conventional students. The 15 studies reporting completion times range from a low of 0.38 to a high of 0.97. However, in no study did CBL students require more instruction time than conventional students (Kulik, 1985c).

Learning for Mastery. Kulik (1986) performed a meta-analysis on 34 studies on Learning For Mastery (LFM) as compared to conventional instruction. Twenty of the studies were at the college level and 14 at the pre-college level. Sixteen studies were from group-paced and 18 were from individually-paced courses. A total of 19 separate variables were identified and analyzed.

The instructional outcome most often measured in all 34 studies was student achievement on final examinations. In this analysis, 32 studies reported a positive ES and two reported a negative but small ES for LFM. Of the 32 studies favoring LFM, 22 studies reported a statistically significant ES in favor of LFM. The average ES for all studies was 0.52 standard deviations. In other words, the average student using LFM

performed at the 70th percentile as compared to the average student in the conventional class who performed at the 50th percentile. Six of the studies compared low aptitude students with high aptitude students. LFM had an especially strong positive effect on the low aptitude student. The one negative effect for LFM was instructional time. On the average in all 34 studies, LFM students required 25 percent more instructional time as compared to conventional instruction.

Overall LFM was equally effective for college and pre-college students. LFM was also equally effective for group-paced and individually-paced instruction (Block, 1989).

Guskey and Gates (1985a) conducted a separate meta-analysis on 35 studies. In their analysis, they reported an average ES of 0.83 SD on final examination scores. In this analysis, elementary students performed better using LFM than college students with ES scores of 0.95 SD and 0.65 SD respectfully. When analyzed by subject, psychology classes out performed science classes, ES of 0.83 SD and 0.49 SD, respectfully.

Guskey and Gates reported student retention as an analysis factor. In four studies, LFM students performed (ES of .62 SD) better than conventional students. In other words, LFM students performed at the 73rd percentile as compared to the 50th percentile for conventional students in recalling learned material as much as four months after course completion.

Overall, Guskey, Gates, and Kulik (cited in Block, 1989) agreed that LFM has a significantly positive effect as a delivery system for almost any subject and at all grade levels. They also agree that LFM can be used to teach higher order skills and lower order skills.

Personalized System of Instruction. A meta-analysis was performed on 75 studies comparing Keller's Personalized System of Instruction (PSI) to conventional instruction at the post-secondary level (Kulik, 1979a). A total of 61 studies reported final exam scores as an analysis factor. In 57 of the 61 studies, PSI was favored with three studies favoring conventional instruction and one study rating them equal. Forty-eight of the 61 studies reported a statistically significant difference favoring PSI. The overall ES for PSI was 0.49 standard deviations. In other words, PSI raised the final examination score for the average student to the 70th percentile as compared to the 50th percentile for the average student in a conventional class. This also indicates that PSI students with SAT scores of 500 perform as well as students with SAT scores of 600 in conventional classes (see Table I).

A total of 11 studies reported a student satisfaction rating. On a five point scale with five representing the highest and one representing the lowest, PSI received a student satisfaction score of 4.19 as compared to conventional instruction which received a score of 3.40. Students not only rated the Keller Plan more enjoyable but more demanding and higher in overall quality and contribution to student learning as compared to conventional instruction (see Table I).

Twenty-seven studies reported student withdrawal rates. In 17 studies withdrawal rates were higher for PSI and in ten studies withdrawal rates were higher for conventional instruction. The overall average effective size was 0.10 SD favoring PSI. The difference in withdrawal rates was not statistically significant and considered approximately equal (see Table I).

Eight studies reported self-paced instruction as compared to teacher-paced instruction (Kulik, 1978). The analysis reported several negative features for self-paced instruction which include teacher frustration, student procrastination, and high withdrawal rates.

Four studies reported student study time. The analysis indicates approximately equal demands on student study time. The differences in study time spent for both PSI and conventional classes seldom amounted to as much as one to two hours for a complete semester.

The most dramatic effect of using PSI as compared to conventional instruction was long term retention of course materials, as Thompson (1985) explained:

> The superiority of PSI over conventional instruction was especially clear on delayed retention measures. PSI produced an improvement of 14 percentage points on exams administered several months after the end of a course (p. 14).

The last item analyzed was settings and outcomes. Kulik (1979a) stated his findings by reporting:

> The PSI effect proved to be stronger for courses in certain disciplines and weaker in other areas. In the physical and life sciences and in the social sciences, PSI final examinations averaged about 5 points higher than examinations in conventional classes; in mathematics and engineering and in psychology, PSI-control differences averaged about 9 points. PSI turned out to equally effective in introductory and nonintroductory courses, and PSI superiority was equally clear at major research universities, less prominent research universities, doctorate-granting universities, comprehensive colleges, liberal arts colleges, community colleges or special institutions (p. 316).

Kulik (1979a) summed up his discussion and conclusion of the PSI meta-analysis this way:

> PSI is effective because it puts into practice what many educators preach. In PSI courses, students move through materials step by step, they receive feedback at every step, and they continue to work on each step until they can demonstrate mastery (p. 27).

Job-Specific Instruction. A meta-analysis was not performed for Job-Specific Instruction (J-SI), but a similar very extensive analysis was made by Zajkowski (1979) and Hall (1982). These studies compared individualized and conventional instruction in US Navy technical training. Conventional instruction (CI) in the Navy should not be confused with civilian conventional instruction. The Navy uses a pipeline system and starts a new class every two weeks. The length and content of any particular course is determined by a job/task analysis for that military occupation. Students are selected for a particular program and have similar aptitudes and abilities. Students spend 30 hours per week in class in two week blocks of instruction. The CI instructional delivery system is very similar to Learning for Mastery (LFM). For example, lectures are the main source of delivery supplemented by written materials. Students are given at least one test during the first week. This test is diagnostic in nature and is used for feedback-corrective information and not counted for grade. Students who fail to reach 80 percent mastery levels are assigned remedial night study for the remainder of the two-week block. A comprehensive examination is given at the end of the two-week block that covers both weeks of materials. Students who fail to reach at least 70 percent mastery on this examination are set back to the class just starting this block and are required to repeat the entire two week segment (Orr, 1987).

Individualized instruction in the US Navy uses programmed instruction and computer-based learning, but it also uses all elements of Personalized System of Instruction (PSI). For example, the

instructional delivery system is primarily computer and self-paced instruction supplemented by lectures (Evans, 1983).

In the study by Hall (1982), data was collected from over 5000 graduates of 19 Navy technical schools. In the findings of this study it was concluded that individualized and Navy conventional instruction were equally effective as delivery systems. This conclusion was based on supervisor ratings of 1,229 CI and 1,186 II graduates who had been on the job at least six months. Individualized instruction was found to benefit higher ability students, who mastered more course content and completed training in less time. Conventional instruction, by comparison, did not benefit one ability group over another. A portion of this study was devoted to course content. Contents of each course were divided into generic training tasks, such as the teaching of facts, category, procedures, rules and principles. Individualized instruction was found to be more effective in teaching psychomotor tasks, and Navy conventional instruction was more effective at teaching cognitive tasks. No one method of instruction was found universally effective in teaching all types of tasks at all ability levels. The study concluded that a teaching method should be selected that best meets the needs of the Navy and the student (Hall, 1982). A separate report by O'Neil (1986) found that computer based learning in the Navy had a time savings for course completion of 32 percent.

Summary. In summarizing the research on individualized instruction for post-secondary students, performance levels were similar for Programmed Instruction, Computer Based Learning, and Audio-tutorial as compared to conventional instruction. Final exam scores on the average

increased by 3.0 percentage points and an overall achievement for an average student increased to the 60th percentile. The one promising trend was CBL, later studies indicate a marked improvement compared to older studies. A most important finding was that CBL reduced student instruction time to two-thirds of that required by conventional instruction (Kulik, 1985c).

The two instructional delivery systems that research indicates are superior at the post-secondary level are Bloom's Learning for Mastery (LFM) and Keller's Personalized System of Instruction (PSI). As Spencer (1988) stated:

> In many ways the work of Bloom and Keller in their mastery learning systems represents the summit of achievement for the neo-behaviourist 'systems' approach to instruction. Both were built on firm, though differing, psychological principles and of all the applications of the behavioural science approach to the technology of education, LFM and PSI represent the only methods which consistently produce significant educational results. Clark (1983) attributes this to the emphasis placed on method, defined by Glaser (1976) as 'the conditions which can be implemented to foster acquisition of competence,' rather than on the media involved in the delivery of instruction, as represented by the physical science approach (p. 98).

Research and Secondary Students

Research paints a somewhat different picture for individualized instruction at the secondary level as compared to the post-secondary level. Research on the outcomes of instruction for LFM, PSI, and CBL are seriously different at the secondary level. LFM and CBL performed much better at the secondary level, while the self-paced feature of PSI performed only slightly better than conventional instruction at the secondary level.

Programmed Instruction. A meta-analysis was performed on 40 studies on Programmed Instruction (PI) at the elementary and secondary levels (Hartley, 1977). All 40 studies were in mathematics and compared PI with conventional instruction. Final examination scores were used as a measure of achievement. The effect of PI at these two levels was marginal. The overall Effective Size was 0.11 standard deviations in favor of PI. In other words, the average PI student performed at the 54th percentile as compared to the 50th percentile for the conventional student.

Two additional meta-analysis were performed on a total of 115 studies comparing PI with conventional instruction (Kulik, 1980a and 1982). These studies were divided into two groups, one group from 1972 and before and the other from 1972 and later. The analysis of these two groups yielded a sharp difference in results. The scores for post-1972 yielded an Effective Size of 0.18 SD, while scores for pre-1972 yielded an ES of -0.06 SD. This small, but positive, Effective Size score for the post-1972 studies is approximately equal to PI scores at the post-secondary level. Therefore, PI and CI are also considered equal at the secondary level.

Computer Based Learning. A meta-analysis was performed on 74 studies from Computer Based Learning (CBL) by Barget-Downs (1985). These studies included grades one through 12 and compared CBL with conventional instruction. All 74 studies used test performance after a period of instruction as a measure of achievement. In ten of the 74 studies, conventional instruction was favored with two studies reporting statistically higher results. In 64 of the 74 studies, CBL was favored with 39 studies reporting statistically significant achievement scores

for CBL. The overall average Effective Size was 0.33 SD favoring CBL. In other words, the average CBL student performed at the 63rd percentile as compared to the 50th percentile for conventional students.

In examining the various effective sizes, variations were noted at different grade levels. The average effective size for grades one through six was 0.42 SD as compared to a 0.26 SD for grades 7-12. The effective size scores also had some variations according to year of publication. Studies published after 1975 reported effective sizes of 0.39 SD for elementary and 0.45 SD for secondary students. Origin of each study was also a factor. At the secondary level, for example, studies taken from dissertations averages only 0.25 SD as compared to 0.47 SD for studies taken from journals and published research reports.

There were variations in the effective size of the analysis for CBL elements. Computer Managed Instruction (CMI) yielded an ES of .40 SD at the secondary level but only an ES of 0.07 SD at the elementary level. Computer Assisted Instruction (CAI) used for tutoring or drill and practice yielded an ES of 0.36 SD at the secondary level and 0.47 SD at the elementary level. Computer Enriched Instruction (CEI) used as simulators of natural phenomena and programmable devices to study mathematical formulas had an effective size of 0.07 SD at the secondary level and was not used at the elementary level. The overall effectiveness of CBL was more pronounced at the secondary level as compared to the post-secondary level. Bangert-Downs (1985) stated:

> Meta-analysis has underscored the very positive record of computer-based education in elementary and secondary schools. CBE has shown itself to be generally effective in a variety of settings. Achievement test scores were especially improved by computer-assisted instruction. Computer-enriched programs at the secondary level were not very effective; but computer-managed courses were more

> successful at the high school level than at the elementary level (p. 7).

Self-Paced Individualized Instruction. A meta-analysis was performed on 51 studies from individualized instruction (II) compared to conventional instruction at the secondary level Bangert (1983). The analysis included studies from PSI, Individually Prescribed Instruction (IPI), and Program for Learning in Accordance with Needed (PLAN). These last two programs are computer managed individualized systems used extensively at the secondary and primary school levels. The analysis did not, however, include studies from Learning for Mastery (LFM) (Thompson, 1985).

The analysis included studies from grades six through 12 that featured division of work into units, individual work at student's own rate, and mastery learning. In 49 studies test performance after a period of instruction was used as a measure of achievement. Bangert (1983) stated:

> The effect of individualized systems on student examination performance varied from study to study. Approximately 65 percent of the 49 studies with examination results reported favorable effects from individualization; approximately 35 percent reported unfavorable effects. Many of these effects, however, were not statistically significant. Only 13 of the 49 studies reported statistically significant differences in examination performances because of teaching methods. Of the studies with significant results, approximately 70 percent favored individualized systems, and approximately 30 percent favored conventional teaching. Overall, the box score results suggested that individualized systems sometimes produced positive and sometimes negative effects on student achievement, but positive effects are somewhat more likely to occur (p. 147).

The overall ES was 0.10 SD in favor of II. This effectively raises the average student from the 50th percentile to the 54th percentile, a very modest improvement.

Forty-four studies reported using self-paced and four studies reported using group-paced instruction. The self-paced studies had an average ES of 0.07 SD while the four group-paced studies reported an ES of 0.35 SD. This indicates the self-pacing feature of individualized instruction is of no advantage over conventional instruction at the secondary level.

Kulik (1984) presented a different picture of the analysis of II at the secondary level. He divided the studies included in Bangert's (1983) meta-analysis into two groups. One group from unpublished dissertations and the other from published journal and formal research reports. The results were quite different than those reported by Bangert. The dissertation group had an average ES of 0.06 SD while the published reports had an average ES of 0.25 SD. These effective size scores for II students at the secondary level are still less than half of the scores from studies of post-secondary students. Kulik (1984) offered a possible explanation:

> It may be that college learners have the cognitive skills required by individualized instruction and that precollege learners lack these skills. To profit from individualized teaching, learners need to be able to pace themselves, make choices, and work independently. College students are better prepared than precollege learners for such tasks (p. 6).

Miller (1985) refers to vocational maturity in his discussion of delaying specific occupational instruction until the post-high period. In the studies referenced by Miller, the problem of maturity and specialized occupational education paralleled the problems of using self-paced individualized instruction at the secondary level. Miller (1985) stated:

> Maley (1969), Thompson (1973), and Leighbody (1972) all see the cluster concept as having application at the secondary level, with specialized preparation in specific occupations

> being left, in most cases, to the postsecondary institutions. Leighbody (ibid) advocates that "specialized occupational preparation should be deferred until the post-high school period" (pp. 173-174). Occupational education should have a prominent place in the high school, but with different objectives. Leighbody emphasizes that the high school years should concentrate upon vocational orientation, exploration, career planning, and vocational decision making. He claims that specialized training in a specific occupation for most high school students is no longer compatible with technological-economic realities, nor with societal norms. For students whose vocational maturity may warrant it, Leighbody calls for a cluster or career development curriculum (p. 125).

Learning for Mastery. A meta-analysis was performed on 35 Learning for Mastery studies at the elementary and secondary levels (Block, 1976 and Guskey, 1985b). The most reported feature was student achievement on final exams with a total of 83 separate reports. An overall effect size for LFM was 0.76 SD. In other words, an average LFM student performed at the 77th percentile as compared to a 50th percentile for an average student using conventional instruction. There is, however, a marked difference in performance of LFM students at different grade levels. The elementary student out performed the college student with effective size scores of 0.95 SD and 0.65 SD, respectfully. Secondary students had an ES of 0.72 SD.

In summary, the two mastery learning systems have proven superior as instructional delivery systems at both the post-secondary and secondary levels. The only negative aspect is the self-paced feature of individualized instruction at the secondary level; it is only slightly better than conventional instruction. Thompson (1985) states that the lower scores for self-paced students at the secondary level were due to lower maturity levels and underdeveloped study skills. Thompson (1985, p. 18) also stated: "The research results suggest that, as educational

level increases, the relative advantage increases for individualized systems of instruction".

This would suggest that students in grades 11 and 12 would benefit more for self-paced instruction than would students in grades nine and ten.

Mastery Learning and Vocational Education

Research indicates that Learning for Mastery and Personalized System of Instruction are superior instructional delivery systems for all type courses and at most levels, including vocational-technical education.

Skill acquisition and development require learning activities which involve both psychomotor and cognitive domains. Thompson (1985) indicates that cognitive and psychomotor domain are separate categories, but it would be within reason that the same learning principles underlie both domains. Thompson (1985) is referring to research completed in the civilian community when she stated:

> There has been a marked lack of research to determine which of the individualized instruction components enhance psychomotor skill development, in contrast to the research on cognitive achievement. One study (Mevarech, 1983) on acquisition of psychomotor, application skill in mechanics classes, compared individualized classes with and without the mastery requirements (the feedback-corrective procedures). The mastery learning requirements led to significantly higher psychomotor ability (p. 21).

In the military community, a great deal of research has been completed on individualized instruction and psychomotor learning. The study by Hall (1982) on Navy technical training reports that the Navy version of individualized instruction was the most effective method for teaching psychomotor skills. Evans (1983) reports similar finding in his study of the elements of Navy technical training.

Competency-Based Vocational Education and Mastery Learning: Complement or Conflict

This review of literature has outlined Competency-Based Vocational Education (CBVE) and Mastery Learning. The remainder of this review will discuss the strengths and weaknesses of CBVE and Mastery Learning. The review will also compare the basic elements of CBVE and Mastery Learning to determine complement or conflict.

Performance Objectives

CBVE is a system that derives its content from the tasks performed in an occupation/job. What a worker needs to know and to what skill level required for entry into an occupation is documented in the form of tasks, standards, and conditions for performance. A task analysis or DACUM is used to collect these tasks from the critical aspects of employment. CBVE also provides a detailed description in how to turn this data into performance objectives for use in developing a course of study (Finch, 1989).

The two systems of mastery learning, Learning for Mastery and Personalized System of Instruction, are primarily concerned with the actual delivery of instructional materials. Objectives are an essential part of mastery learning, but no provisions are provided in how to write objectives. The collection of learning materials is the one weakness of mastery learning. Learning for Mastery (LFM) does provide some guidance with outlining existing objectives, but no detailed information is provided in how to collect or write objectives (Guskey, 1985). Personalized System of Instruction (PSI) simply instructs the reader to

read a good book on how to write objectives before attempting to develop instructional materials (Keller-Sherman, 1974).

Units of Instruction

CBVE recommends using a self-contained unit of instruction built around performance objectives. These units are called modules or learning activity packets (LAPs) (Finch, 1989). The Mid-America Vocational Curriculum Consortium (1985) explains the advantages of units:

> Advantages of Using a Unit of Instruction
>
> 1. All resources are focused toward a measurable goal
> 2. Program become uniform
> 3. Instructional materials are more easily managed
> 4. Teacher is able to fill a broader role
> 5. Standards are established for programs and employment
> 6. Programs become accountable
> 7. Individual needs of students are more easily identified
> 8. Opportunity is provided for in-service instruction on technical content
> 9. Teachers are assisted with program instruction
> 10. Students can be more highly motivated (p. D21)

Mastery learning makes similar recommendations on the use of units. However, PSI and LFM go one step further and state how long a unit should be. LFM, for example, recommends units be from five to ten class hours long with an estimated two to ten hours of homework or home study. PSI recommends units be from three to five class hours long and with an

estimated two to 15 hours of home study (Guskey, 1985 and Sherman 1982). Sherman (1982) stated:

> The available evidence therefore suggests that retention is superior when students demonstrate mastery on short units rather than long ones. Students attitudes toward short and long units seem similar; the amount of study time required by the two kinds of courses may also be similar. There is little empirical support for the idea that short units prevent students from developing an overall view. Instead, demonstrating mastery on short units seems instructionally superior (p. 134).

PSI further recommends a study guide be written instead of a LAP. A study guide relies on text books for written materials and not instructor written materials. Study guides can be developed at a fraction of the cost of a LAP. Multimedia materials are highly recommended when available (Sherman, 1982).

Review Units

Most CBVE systems make no reference to using review units. However, LFM and PSI both use review units. Review units are written the same as a regular unit and are placed at a natural break in the course, usually ever two to eight units of instruction. Research indicates that long term retention is significantly improved in courses using review units as compared to the same course without review units. Final exam scores are significantly better and scores on exams given three to four months after course completion are also significantly better (Sherman, 1982).

Mastery Level

Most CBVE systems provide little or no guidance in how tests are to be constructed or administered. The one exception is that CBVE does require mastery on unit tests (Finch, 1989).

The heart of LFM and PSI is mastery learning based on the performance objectives of the course. Mastery unit tests are criterion-referenced with passing scores of 80 to 100 percent, but usually set at 90 percent. Students who fail to reach mastery level are remediated and retested. LFM requires two parallel tests be written and PSI requires three (Guskey, 1985 and Keller-Sherman, 1974).

Feedback on the results of these criterion-referenced tests is also a factor. In four studies (Kulik, 1978), feedback timing of tests results drastically effected final examination and delayed retention scores. Delayed retention tests were given several months after course completion. Kulik (1978) explained:

> In general, we can conclude that delaying feedback in PSI courses interferes with student retention of course materials. It is not yet clear, however, why timing of feedback affects student retention so drastically. The same mastery standards are required of students who receive immediate and delayed feedback. Yet students who receive delayed feedback retain less. The finding is especially perplexing when one considers that for some kinds of learning tasks, delayed feedback seems superior to immediate feedback (p. 135).

Formative and Summative Testing

Most forms of CBVE provide little or no guidance in how to develop or use formative or summative tests.

In mastery learning, formative testing is used to determine mastery level for a unit of instruction. These tests are diagnostic in nature

and are used primarily to provide feedback information to the student and the instructor. Guskey (1985b) stated:

> Formative tests can take a variety of forms. Most are short quizzes composed of multi-choice or short-answer types of items. But under certain conditions short essays, writing samples, or skill demonstrations can also serve as formative tests. The most important characteristic of a formative test is that it provides students with very precise and immediate feedback on their learning progress that can be used to help remedy learning difficulties. The information gained from a formative test thus serves as a guide for the correction of errors made during the original instruction. In fact, the score students attain on a formative test may not even be counted in determining their grade. The primary use of this test is to check on each student's learning progress and direct further study (p. 35).

In mastery learning summative testing is an essential characteristic and is used to determine grades. As already stated, review units are strategically placed ever 2 to 8 units of instruction. Summative testing is a part of these review units and combined with mid-term and final exams scores are used to determine grades. Guskey (1985b) explained:

> The primary purpose of a summative examination is to gather cumulative information on students' learning so grades can be assigned or competence in a particular skill or task can be determined. Obviously, then, the purpose of a summative exam is clearly different from that of a formative test. A formative is used primarily to check students' learning progress and to pinpoint any learning difficulties they may be experiencing. It is designed to help both the student and teacher focus on the learning that is essential in moving toward mastery. A summative examination on the other hand, is directed toward a much more general assessment. It is used primarily to evaluate the degree to which larger outcomes have been attained over the entire course or a substantial portion of it (p. 79).

Individualized instruction has been criticized for not providing an adequate grading system for students, formative and summative testing solve that problem (Spencer 1988).

Course Management System

Most forms of CBVE provide detailed procedures on how to manage instructional programs. Instructor managed or manual systems are absolute minimum requirements (Finch, 1989).

LFM and PSI both provide detailed management procedures for their instructional programs. Instructor managed or manual systems are also absolute minimum requirements (Guskey, 1985 and Keller-Sherman, 1974).

Computer management is highly recommended but not required for either LFM or PSI. Guskey (1985) stated:

> Classroom computers offer teachers a great many advantages. Because of the speed with which they process information, computers tremendously enhance the immediacy of the feedback students receive from formative tests. Computers also increase the efficiency and accuracy of the feedback information teachers receive on students' learning progress. Furthermore, computers facilitate sharing among teachers by making materials available in a format that is easy to receive and easy to change. For example, when a poorly worded question is identified in a formative test on a computer diskette, it can be easily reworded, replaced, or simply eliminated. If the test is on a ditto master, however, changing in a single item usually means rewriting the entire test (p. 54).

The one outstanding feature of computer managed instruction is the savings in instructional time. Research indicates that computer managed courses on the average use only two-thirds of the instructional time required of conventional instruction (Kulik, 1979). Guskey (1985) and Sherman (1982) both agree that the future use of mastery learning will be greatly enhanced by the use of computers.

Individualized Instruction

LFM and PSI have several elements in common but the two most outstanding features are that both are mastery learning systems and both

are individualized instruction systems. CBVE, as compared to mastery learning, only recommends the use of individualized instruction.

Miller (1985) states his concern for the use of individualized instruction in his discussion of new professional expectations and vocational teacher education. He further states that the future for vocational teacher preparation is not well defined, but that the fact that it will change is clear. Miller (1985) explained:

> In the past, many teacher education programs stressed the fact that no two human beings are alike; therefore, people do not learn at the same rate or do not solve problems in the same way. At the same time that individualized differences were being stressed, teacher education programs did not reflect awareness of the very points being stressed. Some programs did stress the concept of individualized instruction, but without providing any demonstration of its effectiveness. Shill (1976) sums up his concern about personnel preparation by asserting 'Above all, personnel preparation programs effectiveness and impact must be measurable and measured, its impact assessed, and results returned for program refinement and revision' (ibid). Teacher educators are not immune to the need for change; they have the responsibility of acting as desirable role models and of beginning the change 'at home' (p. 85).

One final word on individualized instruction. A review of literature clearly indicates that there are no advantages of self-paced over conventional instruction. In fact there are many negative factors in using self-paced instruction. The review, however, did indicate a superior rating for individualized as compared to conventional instruction (Thompson, 1985).

Summary

A careful analysis of the basic components of Competency-Based Vocational Education and Mastery Learning shows that they do not conflict but actually complement each other. Each focuses on different aspects of the instructional process, and each offers vocational

educators important, but distinctly different, advantages. Furthermore, where each program is potentially weak the other has its major strengths. Therefore, when used together these programs are likely to lead to results far more positive than either could yield if used in isolation.

CHAPTER III

METHODOLOGY

The purpose of this study was to gain insight into the extent to which CBVE has been implemented into the area schools of Oklahoma and to determine if the CBVE instructional delivery systems commonly in use are designed for the most effective results. Specifically, the following sections were discussed: (1) type of research, (2) subjects, (3) instrument development, (4) pilot study, (5) data collection, and (6) analysis of data and statistical analysis.

Type of research

Key (1974) defined descriptive research:

> Descriptive research is used to obtain information concerning the current status of the phenomena. The purpose of these methods are to describe 'what exists' with respect to variables or conditions in the situation (p. 124).

Many important decisions in education can be better made if descriptive data is available. Therefore, the purpose for which descriptive research is conducted is to get a picture of present conditions as a normative basis for making judgments and decisions, Van Dalen (1979) explained:

> Before much progress can be made in any field, scholars must possess descriptions of the phenomena with which they work. Early developments in educational research, therefore, as in other disciplines, have been concerned with making accurate assessments of the incidence, distribution, and relationships of phenomena in the field. To solve problems about children, school administration, curriculum, or the teaching of

> arithmetic, investigators ask the question: What exists--what is the present status of the phenomena? Determining the nature of prevailing conditions, practices, and attitudes--seeking accurate descriptions of activities, objects, processes, and persons--is their objective. But descriptive research is not confined to routine fact gathering. Identifying and clarifying relationships among variables are the goals of many investigators (p. 284).

Cook (1975) lists three types of descriptive research: correlation research, causal-comparative research, and survey research. He further states that survey research is of great importance to educational decision making and is the primary method in which data is collected for the purpose of aiding in management decisions. Van Dalen (1979) explained:

> When trying to solve problems, researchers in educational, governmental, industrial, and political organizations often conduct surveys. They collect detailed descriptions of existing phenomena with the intent of employing the data to justify current conditions and practices or to make more intelligent plans for improving them. Their objective may be not only to ascertain status but also to determine the adequacy of status by comparing it with selected or established standards (p. 286).

This study utilized survey research to collect the data.

Subjects

The subjects of this study were individuals from two groups. The first group were administrators from the Area Vocational Technical Schools of Oklahoma. The second group were instructors who were identified by the administrators as using CBVE in their instructional programs.

Instrument Development

The study utilized two separate instruments to collect data. The first questionnaire was developed for administrators and has two parts.

The first section was utilized to collect data about the general status of CBVE in the area schools. The second section was utilized to request administrators identify instructors who use CBVE in at least 20 percent of their course materials and have permission to participate in a detailed survey on CBVE. Appendix A contains a copy of the instrument. The second questionnaire was designed for instructors and utilized to collect data about the extent to which area vocational schools have implemented CBVE. The instructor questionnaire has four parts, the first section was developed from chapter two of this research project and utilized to collect data concerning the CBVE instructional delivery systems used in the area schools. The second, third, and fourth sections were a modified version of the questionnaire developed, validated and used by the Pennsylvania State Department of Vocational Education in 1985, revised and used again in 1987 to ascertain the extent to which CBVE had been implemented in that state. Appendix B contains a copy of the instrument.

The instruments were tested for clarity by the advisory committee. The instruments were also used as a class project in a graduate research course at Oklahoma State University. Comments and suggestions were used to refine the instruments. The instruments were then employed in a pilot study which was conducted to further refine the instruments.

Pilot Study

A pilot study was conducted during the summer semester of 1989, in order to refine the survey questionnaires for this study. The subjects of this study were administrators and instructors enrolled in occupational and adult education classes at Oklahoma State University.

A second group were the Trade and Industrial (T&I) administrators and instructors employed at Moore Norman AVTS, Norman, Oklahoma.

Two Trade and Industrial classes of undergraduate and graduate students at Oklahoma State University were selected for the pilot study. This writer introduced the study, stated the purpose, and answered individual questions in each class session. The respondents were handed questionnaires to complete. A total of 15 questionnaires were completed and collected for this portion of the pilot study.

The second portion of this pilot study was conducted at Moore-Norman AVTS. This writer introduced the study, stated the purpose, and answered individual questions at each meeting. The respondents were handed questionnaires to complete. A total of 14 questionnaires were completed and collected from this part of the pilot study.

Data Collection

The administrator instrument and accompanying cover letter (see Appendix C) were sent by mail to administrators in all area vocational schools in Oklahoma listed on page 96 of the Vo-Tech Personnel Directory, Year 88-89 (N = 50). The administrators identified 569 instructors, out of total population of 820, who were using CBVE in at least 20 percent of their course materials and had permission to participate in a research project. Twenty-two names were found to be unusable for purposes of this research project. The instructor instrument and accompanying cover letter (see Appendix B) were sent by mail to the instructors (N = 547) identified by the administrators. The

subjects were asked to complete the questionnaire and return it in the enclosed self-addressed, stamped envelope.

The guide to mastery learning developed from chapter two of this research project was designed to answer research question one, "What are the most effective mastery learning instructional delivery systems used in educational institutions today, as identified by a review of literature". The administrators instrument and sections two and three of the instructor instrument were designed to answer research question two, "To what extent has Oklahoma area vocational technical schools implemented competency based vocational education". The analysis guide for instructional delivery systems and the check list for evaluating CBVE instructional delivery systems, both developed from chapter two of this research project, along with all elements of the instructor and administrator instruments, were designed to answer research question three "What are the characteristics of the CBVE instructional delivery systems as they exist in the area vocational technical schools of Oklahoma".

Analysis of Data and Statistical Analysis

To answer the research questions, first, the instructor instruments were divided into seven groups corresponding to the seven divisions of a typical area school. These divisions were Agriculture, Business and Office, Marketing, Health Occupations, Special Programs, Home Economics, and Trade and Industrial. The mean, a measure of central tendency, was then calculated for each of the instrument data questions for each group. A tabulation with a total was used for questions with a yes, no, or unknown answer. A mean was also calculated for the administrator

instrument data questions. Jaccard (1983, p. 47) stated: "The mean is simply the arithmetic average of the scores. It is computed by summing all the scores and dividing this sum by the total number of scores". The mean was calculated by utilizing a statistical package designed for personal computers (Bolding, 1985).

The analysis plan is listed below for each research question taken from chapter one of this research project.

Research Question One

Q1: What are the most effective mastery learning instructional delivery systems used in educational institutions today, as identified by a review of literature?

In order to address research question one, an extensive review of literature was conducted on CBVE and mastery learning. As indicated in chapter two of this research project, the two most effective mastery learning instructional delivery systems were learning for Mastery and Personalized System of Instruction. The following analysis guide for instructional delivery systems, was developed from the handbooks on how to develop course materials for these two learning systems.

Research Question Two

Q2: To what extent has Oklahoma Area Vocational Technical Schools implemented competency based vocational education?

In order to address research question two, the administrators were asked to provide general information concerning the development of CBVE at their school and to identify instructors who were using CBVE in at least 20 percent of their course materials. The administrator

instrument also made a formal request for permission to conduct research at each school.

The instructor instrument ask instructors to rate, on a five point Likert scale, the extent of implementation of the ten elements listed in the instructor instrument. A calculated mean is listed as the Instructor Instrument Mean rating for sections two and three which include:

A. Define Scope of Course,

B. Validate Occupational Competencies,

C. Identify Terminal Performance Objectives,

D. Identify Sequential Performance Steps,

E. Determine Resources Requirements,

F. Determine Task Sequence,

G. Assess Student Performance,

H. Identify Instructional Program Content,

I. Design Learning Management System,

J. Conduct Course Evaluation.

Research Question Three

Q3: What are the characteristics of the CBVE instructional delivery systems as they exist in the Area Vocational Technical Schools of Oklahoma?

In order to address research question three, the data collected was grouped into seven groups corresponding to the seven divisions found in a typical area school of Oklahoma.

The analysis guide for instructional delivery systems, presented below, along with the check list for evaluating CBVE instructional

delivery systems were used to compile the instructional delivery systems mean ratings used in this study.

Analysis Guide for Instructional Delivery Systems

I. Instructional Delivery Systems

A. Course Policy/Administration

1. LFM and PSI are instructional delivery systems, independent of course content.
2. LFM and PSI are both compatible with CBVE and CBL.
3. PSI is an individually-paced system that can be operated open-entry/open-exit.
4. LFM is a grouped-paced individualized system that can operate on the semester system or open-entry open-exit.
5. Lectures supplemented with instructional materials is an important feature of LFM.
6. Instructional materials supplemented by lectures are an important feature of PSI.

B. Units of Instruction

1. Each course is divided into individual units of instruction.
2. Each unit should be a maximum of five to six hours in length, preferably two to three hours for PSI.
3. Small unit size with frequent quizzes or tests to measure each step is an important feature of PSI.
4. Unit length can average ten hours in length for LFM.
5. A study guide/LAP must be developed for each unit or review unit of instruction.

6. Performance objectives are required.
7. Study or review questions must be included for each important point of a unit.
8. Commercially published textbooks should be used when available.
9. Internally developed text material should not be used except when absolutely necessary.
10. All home-grown text materials should have extensive pilot studies performed before use.
11. Multi-media study materials should be used where available.

C. Performance Objectives
   1. Performance Objectives are required for CBVE and Mastery Learning.
   2. Standards of performance.
   3. Conditions of performance.

D. Review Units
   1. Review units should be used ever two to eight units of instruction.
   2. Review units can be written the same as a regular unit of instruction.
   3. Review units are required for mastery learning.
   4. Summative testing used for review units.

E. Mastery Learning
   1. Based on performance objectives.
   2. Formative diagnostic testing used to provide feedback and correctives.

3. Cognitive and affective unit mastery levels should be set at 90 percent.
4. Criterion-referenced testing is required.
5. Students are not allowed to proceed to the next unit of instruction until mastery is accomplished.
6. Mastery level for psychomotor or performance tests should be set to occupational standards.
7. Summative mid-term and/or final exams required.

F. Course Management System

1. Computer managed instruction (CMI) is recommended.
2. CMI combined with CAI reduces instruction time by 33 percent.
3. A manual grading system is required.
4. Immediate feedback on tests and quizzes is an important feature.
5. A folder and progress chart for each student is required.
6. Unit test rules must be written and understood by all in advance.
7. Two parallel unit exams are required for LFM, three for PSI.
8. Summative test determine major part of test grade.
9. Formative testing determine mastery but is only a minor part of test grade.
10. Unit contracts are highly recommended for courses using open-entry/open-exit.
11. Lab units should follow the cognitive unit.

12. Lab units should not be attempted until the cognitive units have been mastered.

G. Pacing Formats

1. Self-paced is not a requirement for either LFM or PSI.
2. Self-paced appears to contribute to student morale and general satisfaction with a course.
3. Teacher-paced, with fixed completion times, successfully reduces student procrastination and lowers withdrawal rates
4. Computer-paced is the most efficient pacing format.
5. Group-paced is used in programs that have fixed-time mastery level learning requirements.

The Check List with Questions for Evaluating CBVE Instructional Delivery Systems (Table II) uses a 100 point rating scale referenced to the questions from the instructor instrument. The check list was developed for this project by combining what research indicated were the most effective elements of Learning for Mastery and Personalized System of Instruction. The questions used for each element are listed immediately below that element. The maximum score for each element is as follows: 15 points for course management, 15 points for use of performance objectives, ten points for using review units, ten points for using individualized instruction, ten points for length of time for units, ten points for using criterion-referenced testing, five points for having multiple tests for each unit, five points for using mid-term or final exams, five points for using multi-media materials, five points for using diagnostic testing, five points for developing a study guide for each unit, and five points in use of feedback of test results.

TABLE II

CHECK LIST WITH QUESTIONS FOR EVALUATING
CBVE INSTRUCTIONAL DELIVERY SYSTEMS

SCORE.	100 Point Rating Scale Referenced to Teacher Survey.
____	1. 15 pts- Course Management System*
	3.18 A system to convert performance on objectives to a conventional grading scale is in place and known to students.
	3.21 A manual system developed to monitor progress and provide feedback information to students.
	3.22 Computer Managed Instruction developed to monitor progress and provide for continuous feedback to students.
____	2. 15 pts- Performance Objectives
	3.4 Performance objectives from appropriate competency lists identified and reviewed.
	3.5 Performance objectives written for tasks where none were available.
	3.17 Tests constructed for each performance objective based upon established standards.
____	3. 10 pts- Review Units
	1.6 Does your course have review units at specific intervals in the course, for example after ever two or three units?
____	4. 10 pts- Individualized Instruction
	1.4 What percentage of your program is individually-paced instruction?
____	5. 10 pts- Length of Time for Each Unit
	1.5 What is the completion time, in class hours, for an average sized unit of instruction in your course?

TABLE II (Continued)

SCORE.	100 Point Rating Scale Referenced to Teacher Survey.
____	6. 10 pts- Criterion-Referenced Testing 1.7 What is the minimum passing grade for each unit test or quiz? 1.10 Do you use criterion-referenced testing in your course?
____	7. 5 pts- Multiple Tests for Each Unit 1.2 Is there more than one parallel examination for each unit of instruction?
____	8. 5 pts- Mid-term and/or Final Exams 1.9 Do you use mid-term and/or final exams in your course?
____	9. 5 pts- Multi-Media Materials 1.3 Is a multimedia choice of study materials available for most units of instruction, for example video tape or sound/slides?
____	10. 5 pts- Diagnostic Testing 1.11 Do you use diagnostic testing to provide feedback and to prescribe remedial instruction for each unit?
____	11. 5 pts- Study Guide for Each Unit 1.1 Is your course divided into units of instruction; if so what do you call these units?
____	12. 5 pts- Feedback of Test Results 1.8 What is the average time for feedback of test results to reach students in your course?
____	TOTAL

* Questions used to assign points for the analysis were taken from the instructor questionnaire.

Items listed below were taken from the administrator instrument and sections two and four of the instructor instrument. These items listed below were used to analyze the general status of CBVE at Area Schools. The data collected is listed as administrator's response to questions about CBVE in their school.

A. Administrator Instrument

1.A Is your school presently using CBVE?

1.B If yes, how long has your school used CBVE?

1.C Does your school maintain a verified competency/tasks list for each program using CBVE?

2.0 Does your school employ a full-time curriculum development specialist?

B. Instructor Instrument

1.4 What percentage of you program is individually-paced instruction?

1.12. For what percentage of your course do you use the state curriculum?

4.3 Number of years vocational teaching experience:

4.4 Number of years industrial experience:

4.5 Number of years using CBVE:

CHAPTER IV

PRESENTATION OF FINDINGS

This chapter presents the findings of the research. There are four sections in this chapter. The first section presents general information regarding the respondents. Data pertinent to the three research questions are presented in the successive sections. Chapter V is devoted to summary, conclusions, and recommendations from the study. The purpose of this research was to gain insight into the extent to which CBVE has been implemented into the area schools of Oklahoma and to determine if the CBVE instructional delivery systems commonly in use are designed for the most effective results.

To present the findings of this paper and answer the research questions a mean, a measure of central tendency was calculated for all variables, except for questions with a yes, no, or unknown answer. A tabulation with a total was used for these questions. Data from forty-four administrator and three hundred fourteen instructor questionnaires were used to answer the three research questions.

Responses

Administrator instruments were sent to all 50 area vocational-technical schools in Oklahoma. Administrators from 47 area schools completed and returned questionnaires for a return rate of 94 percent.

The administrator's identified 569 instructors who were using CBVE in at least 20 percent of their course materials; however, 22 of these names were deemed unusable.

Five hundred forty-seven questionnaires were mailed to the selected instructors. Three hundred eighteen questionnaires were completed and returned for a return rate of 58 percent. Four of the questionnaires were improperly completed, leaving 314 usable questionnaires for the study.

Table III shows the general information from the administrator instruments. Forty-four of the schools responding indicated that they use CBVE. Three schools stated that they did not. The administrators indicated that they have used CBVE for an average of 6.7 years. Forty-two schools indicated that they maintain a verified competency/task list for each program using CBVE, two schools indicated that they did not. Twelve schools reported having one or more full-time curriculum development specialist and 32 did not.

Table IV shows the general information from the instructor instruments. Instructors were ask what percentage of their course materials was individually-paced. Table IV shows the mean of the percentages reported by the instructors by group as follows: agriculture, 75 percent; business and office, 79 percent; health, 25 percent; home economics, 37 percent; marketing, 65 percent; special programs, 63 percent; and trade and industrial, 52 percent. Instructors were ask for what percentage of your course do you use the state curriculum. Table IV shows the mean of the percentages reported by instructors for each group as follows: agriculture, 83 percent; business and office, 11 percent; health, 57 percent; home economics, 63

TABLE III

ADMINISTRATOR'S RESPONSE TO QUESTIONS
ABOUT CBVE AT THEIR SCHOOL

Question Number	Question	Response
1.A	Is your school presently using CBVE?	
	Yes	44
	No	3
1.B	If yes, how long has your school used CBVE?	
	Average Number of Years	6.7
1.C	Does your school maintain a verified competency/ tasks list for each program using CBVE?	
	Yes	42
	No	5
2.0	Does your school employ a full-time curriculum development specialist?	
	Yes	12
	No	32

N = 47

TABLE IV

INSTRUCTOR MEAN RESPONSE TO QUESTIONS
ABOUT CBVE AT THEIR SCHOOL

Number	Question	Instructors Reporting	Mean
1.4	What percentage of your program is individually-paced instruction?		
	Agriculture	2	75%
	Business and Office	50	79%
	Health	42	25%
	Home Economics	16	37%
	Marketing	10	65%
	Special Programs	13	63%
	Trade and Industrial	181	52%
	Total All Instructors	314	57%
1.12	For what percentage of your course do you use the state curriculum?		
	Agriculture	2	83%
	Business and Office	50	11%
	Health	42	57%
	Home Economics	16	63%
	Marketing	10	52%
	Special Programs	13	18%
	Trade and Industrial	181	43%
4.3	Number of years vocational teaching experience all instructors:	314	9.2
4.4	Number of years industrial experience:		
	Agriculture	2	12.5
	Business and Office	50	8.0
	Health	42	11.0
	Home Economics	16	11.5
	Marketing	10	13.0
	Special	13	9.5
	Trade and Industrial	181	14.5
4.5	Number of years using CBVE all instructors:	314	5.7

N = 314

percent; marketing, 52 percent; special programs, 18 percent; and trade and industrial, 43 percent. Three hundred fourteen instructors reported years of vocational teaching experience. The average for all respondents was 9.2 years. When asked to indicate years of industrial experience the average number of years reported for each group was: agriculture, 12.5; business and office, 8.0; health, 11.0; home economics, 11.5; marketing, 13.0; special programs, 9.5; and trade and industrial, 14.5. When ask to report years of experience using CBVE, the average number of years using CBVE was 5.7 for all reporting instructors.

Research Question Findings

To answer the research questions, the mean, a measure of central tendency (Boling, 1985) were calculated for each of the data questions from the instructor and administrator instruments. For section one of the instructor instrument, the instruments were divided into seven groups corresponding to the seven divisions of a typical area school, agriculture, business and office, health, home economics, marketing, special programs, and trade and industrial. A mean was calculated for the variables from each of these groups. The responses from section one were graded according to the analysis guide for instructional delivery systems using the 100 point grading scale as outlined in chapter three of this research paper. In section two of the instructor instrument, the instructors were ask to respond to questions by indicating a yes, no or unknown. In section three, the instructors were asked to rate their CBVE program on a likert scale. The range for each of these questions was: four (fully implemented), three (moderately implemented), two

(minimally implemented), one (not yet implemented), and zero (unknown). A mean of 0 to 1.5 was considered as not yet implemented; 1.51 to 2.5 as minimally implemented; 2.51 to 3.5 as moderately implemented; and 3.51 to 4.0 as fully implemented. Forty-seven comments were obtained from section four of the instructor instrument (see Appendix E).

Research Question Number One

Chapter two of this research project was designed to answer research question one, "What are the most effective mastery learning instructional delivery systems used in educational institutions today, as identified by a review of literature." In order to address research question one, an extensive review of literature was conducted on CBVE and mastery learning. As indicated in chapter two of this research project, two mastery learning systems were identified. Research indicated that the two most effective instructional delivery systems were Learning for Mastery (LFM) and Personalized System of Instruction (PSI). These two instructional delivery systems are also mastery learning systems. Table V, a guide to mastery learning, along with the analysis guide for instructional delivery systems were developed from the handbooks on how to develop course materials for these two learning systems.

Research Question Number Two

Sections two and three of the instructor instrument were designed to answer research question two, "To what extent has Oklahoma area vocational-technical schools implemented competency based vocational education." Table VI shows the response to the five questions in

TABLE V

A GUIDE TO MASTERY LEARNING SYSTEMS

	MASTERY LEARNING MODELS	
Characteristics	LFM	PSI
Basis of Instruction	Group	Individual
Pace of Instruction	Group-Paced Teacher-Paced Computer-Paced Self-Paced	Teacher-Paced Computer-Paced Self-Paced
Primary Source of Instruction	Teacher, supplemented by materials	Materials, Supplemented by the teacher
Standard of Mastery	80-90%	80-95%
Number of Retake Tests per Unit	One	As Many as Needed for Mastery
Remedials	New and Different materials	Restudy original Materials
Time Management	Semester	open-entry/open-exit
Comparison Analysis: Avg. ML Student Avg. CI Student	 Performed at 77% Performed at 50%	 Performed at 70% Performed at 50%
Major Applications or Levels	Post-Secondary Secondary Elementary	Post-Secondary Secondary
Weakness of System	Excessive Time	Less effective at Secondary Level
Strengths	Superior at secondary and elementary levels	Superior at Post-Secondary level
Compatible with Computer-Based Learning	Yes	Yes

TABLE VI

INSTRUCTOR RESPONSE TO HOW THEY DEFINE THE SCOPE OF A COURSE

Question Number	Question	Response
2.1	The title of your course is defined by the "Dictionary of Occupational Titles" (D.O.T.) by code and title.	
	Yes	199
	No	49
	Unknown	59
2.2	The course description written for your course is based on the D.O.T.	
	Yes	152
	No	76
	Unknown	79
2.3	The course description written for your vocational program is verified by an advisory committee.	
	Yes	280
	No	17
	Unknown	10
2.4	Employment opportunities for students in your vocational program are projected for 3-5 years from labor market data and advisory committee feedback.	
	Yes	226
	No	50
	Unknown	31
2.5	Anticipated technological changes in your occupation are determined from industry and advisory committee feedback.	
	Yes	299
	No	5
	Unknown	3

N = 314

section two of the instructor instrument, as follows: 199 instructors use the Dictionary of Occupational Titles (D.O.T.) to define the title of their course, 49 instructors do not and 59 responded with unknown. When asked if their course description was based on the D.O.T., 152 instructors said yes, 76 said no, and 79 answered with unknown. When asked if employment opportunities for their students were projected from labor market data and advisory committee feedback, 226 instructors said yes, 50 said no, and 31 answered with unknown. When asked if anticipated technological changes in their occupation were determined from industry and advisory committee feedback, 299 instructors said yes, five said no, and three reported unknown.

Table VII through XV shows the survey results for section three of the instructor instrument. Table VII shows how respondents answered the questions on how to validate occupational competencies. The respondents reported a mean of 3.33 for using a verified competency list and a mean of 3.10 for an instructor developed task analysis. This indicates that these two methods were moderately implemented by the respondents. The respondents also reported a mean of 3.28 for advisory committee approval of occupational task for their vocational programs, and a mean average of 3.24 for all three questions.

Table VIII shows how respondents answered the questions on how to identify valid terminal performance objectives for each task. Respondents reported a mean of 3.36 for using competency lists and a mean of 3.23 for instructor developed methods of identifying performance objectives for a course of instruction. The respondents also reported a mean of 3.02 for advisory committee approval of identified performance objectives and a mean average of 3.21 for all three questions. The mean

TABLE VII

INSTRUCTOR RESPONSE TO HOW THEY VALIDATE OCCUPATIONAL COMPETENCIES

Question Number	Question	Mean*
3.1	Verified competency lists were reviewed by instructor(s) to identify occupational tasks for vocational program.	3.33
3.2	A task analysis was developed by instructor(s) to identify occupational tasks for vocational program where none were available.	3.10
3.3	Occupational tasks for vocational program reviewed and approved by advisory committee based upon industry needs.	3.28
	Mean Average	3.24

*Note. Ratings can range from a low of zero to a high of four.

N = 314

TABLE VIII

INSTRUCTOR RESPONSE TO HOW THEY IDENTIFY VALID TERMINAL PERFORMANCE OBJECTIVES FOR EACH TASK

Question Number	Question	Mean*
3.4	Performance objectives from appropriate competency lists identified and reviewed.	3.36
3.5	Performance objectives written for tasks where none were available.	3.23
3.6	Performance objectives reviewed by advisory committee to determine validity of conditions, performance, and standards.	3.02
	Mean Average	3.21

*Note. Ratings can range from a low of zero to a high of four.

N = 314

of each question, plus the mean average, indicate these items were moderately implemented by the respondents.

Table IX shows how respondents answered questions on how to identify sequential performance steps for each task. Respondents reported a mean of 3.11 for using existing competency lists and a mean of 2.97 for instructor developed methods of identifying performance steps. Respondents reported a mean of 2.79 for advisory committee approval of performance steps. All three means, plus a mean average of 2.95, indicate these items were moderately implemented by the respondents.

Table X shows respondents answered questions on how to determine resources required to perform tasks. Respondents reported a mean of 3.30 for using competency tool and equipment lists, and a mean of 3.30 for using additional tool and equipment lists. Respondents reported a mean of 3.40 for identifying classroom and laboratory requirements and a mean of 3.34 for identifying reference materials. Respondents also reported a mean of 2.81 for advisory committee approval of finalized resource list. The response to all five questions plus the mean average of 3.23 indicate these items were moderately implemented by respondents.

Table XI shows how respondents answered questions on how to determine required task sequence. The respondents reported a mean of 3.18 for using an existing competency list and a mean of 3.31 for using lists developed by the instructor. The mean of the two items plus a mean average of 3.25 indicate these were moderately implemented by respondents.

Table XII shows how respondents answered questions on how to assess student performance for each objective. The respondents reported a mean

TABLE IX

INSTRUCTOR RESPONSE TO HOW THEY IDENTIFY SEQUENTIAL PERFORMANCE STEPS FOR EACH TASK

Question Number	Question	Mean*
3.7	Performance guides in existing competency lists reviewed for content and sequence.	3.11
3.8	Performance steps written and sequenced for tasks where none were available.	2.97
3.9	Performance steps and sequence for all identified tasks reviewed and approved by advisory committee.	2.79
	Mean Average	2.95

*Note. Ratings can range from a low of zero to a high of four.

N = 314

TABLE X

INSTRUCTOR RESPONSE TO HOW THEY DETERMINE RESOURCES REQUIRED TO PERFORM TASKS

Question Number	Question	Mean*
3.10	Competency tool and equipment lists analyzed for application to task performance.	3.30
3.11	Additional tools and equipment identified for tasks.	3.30
3.12	Classroom and laboratory requirements identified and documented.	3.40
3.13	Reference materials identified for each task.	3.34
3.14	Finalized resource list reviewed and approved by advisory committee.	2.81
	Mean Average	3.23

*Note. Ratings can range from a low of zero to a high of four.

N = 314

TABLE XI

INSTRUCTOR RESPONSE TO HOW THEY DETERMINE REQUIRED TASK SEQUENCE

Question Number	Question	Mean*
3.15	Determine sequence of task from competency lists.	3.18
3.16	Determine sequence of tasks developed by instructor.	3.31
	Mean Average	3.25

*Note. Ratings can range from a low of zero to a high of four.

N = 314

TABLE XII

INSTRUCTOR RESPONSE TO HOW THEY ASSESS STUDENT PERFORMANCE FOR EACH OBJECTIVE

Question Number	Question	Mean*
3.17	Tests constructed for each performance objective based upon established standards.	3.39
3.18	A system to convert performance on objectives to a conventional grading scale is in place and known to students.	3.44
	Mean Average	3.42

*Note. Ratings can range from a low of zero to a high of four.

N = 314

of 3.39 for using established standards and a mean of 3.44 for a system to convert performance on objectives to a conventional grading scale. The mean of these two items plus the mean average of 3.42 indicate these items were moderately implemented.

Table XIII shows how respondents answered questions on how to identify instructional program content for each student. The respondents reported a mean of 3.05 for identifying tentative carer goals for students and a mean of 2.73 for determining student entry level skills and program placement. The mean of both responses, plus a mean average of 2.89, indicate these items were moderately implemented.

Table XIV shows how respondents answered questions on how to design a learning management system. A mean of 3.23 was reported for the development and use of a manual learning management system and a mean of 1.75 for developing and using computer managed instruction. The mean average of 2.49 and the mean of 3.23 for using a manual learning management system were moderately implemented. However, the use of computer managed instruction was considered minimally implemented.

Table XV shows how respondents answered questions on how to conduct a course evaluation. A mean of 2.77 was reported for using on-the-job surveys to assess graduate performance and a mean of 2.98 for using course completion questionnaires, follow-up data, and advisory committee feedback for course revision. A mean average of 2.87, plus responses to both questions, indicate moderate implementation for these items. Table XIV also shows the overall mean average for all twenty-four questions for section three of the instructor instrument. The overall mean average of 3.10 would indicate that overall CBVE was moderately

TABLE XIII

INSTRUCTOR RESPONSE TO HOW THEY IDENTIFY INSTRUCTIONAL PROGRAM CONTENTS FOR EACH STUDENT

Question Number	Question	Mean*
3.19	Tentative career goals identified and documented for each student.	3.05
3.20	Student entry level skills assessed to determine initial instructional placement in program.	2.73
	Mean Average	2.89

*Note. Ratings can range from a low of zero to a high of four.

N = 314

TABLE XIV

INSTRUCTOR RESPONSE TO HOW THEY DESIGN A LEARNING MANAGEMENT SYSTEM

Question Number	Question	Mean*
3.21	A manual system developed to monitor progress and provide feedback information to students.	3.05
3.22	Computer Managed Instruction developed to monitor progress and provide for continuous feedback to students.	1.73
	Mean Average	2.89

*Note. Ratings can range from a low of zero to a high of four.

N = 314

TABLE XV

INSTRUCTOR RESPONSE TO HOW THEY CONDUCT A COURSE EVALUATION

Question Number	Question	Mean*
3.23	On-the-job performance of graduates assessed through employer feedback via local surveys.	2.77
3.24	Student course completion questionnaires, follow-up data, and advisory committee feedback compiled for use in course revision.	2.98
	Mean Average	2.87
	Overall Mean Average	3.10

*NOTE. Ratings can range from a low of zero to a high of four.

N = 314

implemented by those instructors responding to the instructor instrument.

Research Question Number Three

Section one of the instructor instrument was designed to answer research question three, "What are the characteristics of the CBVE instructional delivery systems as they exists in the area vocational-technical schools of Oklahoma." In order to answer research question three, all instructor instruments were divided into seven groups corresponding to the seven divisions of a typical area school in Oklahoma. These divisions are agriculture, business and office, health, home economics, marketing, special programs and trade and industrial. Eleven questions from section one of the instructor instrument and six questions from section three of the instructor instrument were used in the analysis of the instructional delivery systems. Each question was graded and points assigned for each instructor's response by comparing the response to the check list with questions for evaluating CBVE instructional delivery systems, as outlined in chapter three of this research project. In rating questions with a yes, no, or unknown response, a five- and a ten-point scale was used. The range of the five point questions was: five points (yes), one point (no), and zero points (unknown). The range for the ten point questions was: ten points (yes), two points (no), and zero points (unknown). The variable data questions were rated on a percentage basis. The range of the variable data questions was: one point for each 10 percent, rounded to the nearest whole percent, for example 45 percent equals 4.5 points. A mean was

calculated for the response to each question and for each group of instructors.

Tables XVI shows how respondents were rated on their instructional delivery system, both by question and by group. The maximum points for each category for the 100 point rating scale is as follows: 15 points for course management system, 15 points for performance objectives, ten points for review units, ten points for individualized instruction, ten points for length of time for a unit, ten points for criterion-referenced testing, five points for multiple tests for units, five points for mid-term and final exams, five points for multi-media materials, five points for diagnostic testing, five points for a study guide for each unit, and five points for feedback of tests results. The instructor instrument question number is also listed immediately below its corresponding category.

Two agriculture instructors responded to the questionnaire. Table XVI shows the mean score for their response to each questions as follows: course management system ten points, performance objectives 13 points, review units six points, individualized instruction 7.5 points, unit time ten points, criterion-referenced testing one point, multiple tests one point, mid-term and final exams one point, multimedia materials three points, diagnostic testing one point, study guides five points, and feedback of tests results zero points. The total for agriculture was 58.5 points.

Fifty business and office instructors responded to the questionnaire. Table XVI shows the mean score for the response to each question as follows: course management 12.2 points, performance objectives 13.2 points, review units 6.2 points, individualized

TABLE XVI

EVALUATION OF THE CBVE INSTRUCTIONAL DELIVERY SYSTEMS IN THE AREA VOCATIONAL-TECHNICAL SCHOOLS OF OKLAHOMA

100 Point Rating Scale Referenced to Instructor Instrument

	Agri	B&O	Health	Home Ec	Market	T&I	Special	Total
1. Number of Reporting Instructors	2	50	42	16	10	181	13	314
2. Course Management System (15)* (3.18, 3.21, 3.22)	10.0	12.2	11.4	10.6	11.2	11.3	12.1	11.3
3. Performance Objectives (15) (3.4, 3.5, 3.17)	13.0	13.2	13.7	11.6	12.5	12.9	13.0	12.8
4. Review Units (10) (1.6)	6.0	6.2	3.5	4.0	5.0	5.6	6.8	5.3
5. Individualized Instruction (10) (1.4)	7.5	7.9	2.5	3.7	6.5	5.2	6.3	5.7
6. Length of Time for Unit (10) (1.5)	10.0	2.8	5.6	4.5	7.6	3.4	3.2	5.3
7. Criterion-Reference Testing (10) (1.7, 1.10)	1.0	5.5	6.1	6.1	6.0	6.1	3.9	5.0
8. Multiple Tests for Unit (5) (1.2)	1.0	3.4	2.8	3.5	1.8	3.4	4.3	2.9
9. Mid-term and Final Exams (5) (1.9)	1.0	2.9	4.1	4.5	1.8	3.7	3.5	3.1
10. Multi-Media Materials (5) (1.3)	3.0	2.8	4.4	3.9	4.6	4.3	4.3	3.9
11. Diagnostic Testing (5) (1.11)	1.0	2.5	1.9	2.3	2.2	2.6	2.7	2.2
12. Study Guide for Each Unit (5) (1.1)	5.0	4.9	4.9	5.0	5.0	4.9	5.0	5.0
13. Feedback of Test Results (5) (1.8)	0.0	2.3	1.9	1.8	2.7	2.5	3.4	2.1
14. TOTAL (100)	58.5	66.6	62.8	61.5	66.9	65.9	68.5	64.6

* Questions were taken from the instructor questionnaire

instruction 7.9 points, unit time 2.8 points, criterion-referenced testing 5.5 points, multiple tests 3.4 points, mid-term and final exams 2.9 points, multimedia materials 2.8 points, diagnostic testing 2.5 points, study guides 4.9 points, and feedback of tests results 2.3 points. The total for business and office was 66.6 points.

Forty-two health instructors responded to the questionnaire. Table XVI shows the mean score for the response to each question as follows: course management 11.4 points, performance objectives 13.7 points, review units 3.5 points, individualized instruction 2.5 points, unit time 5.6 points, criterion-referenced testing 6.1 points, multiple tests 2.8 points, mid-term and final exams 4.1 points, multi-media materials 4.4 points, diagnostic testing 1.9 points, study guides 4.9 points, and feedback of tests results 1.9 points. The total for health was 62.8 points.

Sixteen home economics instructors responded to the questionnaire. Table XVI shows the mean score for the response to each question as follows: course management 10.6 points, performance objectives 11.6 points, review units four points, individualized instruction 3.7 points, unit time 4.5 points, criterion-referenced testing 6.1 points, multiple tests 3.5 points, mid-term and final exams 4.5 points, multi-media materials 3.9 points, diagnostic testing 2.3 points, study guide five points, and feedback of tests results 1.8 points. The total for home economics was 61.5 points.

Ten marketing instructors responded to the questionnaire. Table XVII shows the mean score for their response to each questions as follows: course management 11.2 points, performance objectives 12.5 points, review units five points, individualized instruction 6.5 points,

unit time 7.6 points, criterion-referenced testing 6 points, multiple tests 1.8 points, mid-term and final exams 1.8 points, multi-media materials 4.6 points, diagnostic testing 2.2 points, study guides five points, and feedback of tests results 2.7 points. The total for marketing was 66.9 points.

One hundred eighty one trade and industrial instructors responded to the questionnaire. Table XVI shows the mean score for their response to each question as follows: course management 11.3 points, performance objectives 12.9 points, review units 5.6 points, individualized instruction 5.2 points, unit time 3.4 points, criterion-referenced testing 6.1 points, multiple tests 3.4 points, mid-term and final exams 3.7 points, multi-media materials 4.3 points, diagnostic testing 2.6 points, study guides 4.9 points, and feedback of tests results 2.5 points. The total for trade and industrial was 65.9 points.

Thirteen special programs instructors responded to the questionnaire. Table XVI shows the mean score for their response to each question as follows: course management 12.1 points, performance objectives 13 points, review units 6.8 points, individualized instruction 6.3 points, unit time 3.2 points, criterion-referenced testing 3.9 points, multiple tests 4.3 points, mid-term and final exams 3.5 points, multi-media materials 4.3 points, diagnostic testing 2.7 points, study guides five points, and feedback of tests results 3.4 points. The total for special programs was 68.5 points.

A total of 314 instructors responded to the questionnaire. A mean average was calculated for each question by calculating the total points for each question and dividing by three hundred fourteen. Table XVI shows the overall mean average score for each of the questions as

follows: course management 11.3 points, performance objectives 12.8 points, review units 5.3 points, individualized instruction 5.7 points, unit time 5.3 points, criterion referenced testing 5.0 points, multiple tests 2.9 points, mid-term and final exams 3.1 points, multi-media materials 3.9 points, diagnostic testing 2.2 points, study guides five points, and feedback of tests results 2.1 points. The total for all instructors participating in this research project was 64.6 points.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to gain insight into the extent to which CBVE has been implemented into the area schools of Oklahoma and to determine if the CBVE instructional delivery systems commonly in use are designed for the most effective results.

There were three specific research questions for the study. The research questions were:

1. What are the most effective mastery learning instructional delivery systems used in educational institutions today, as identified by a review of literature?

2. To what extent has Oklahoma area vocational-technical schools implemented competency based vocational education?

3. What are the characteristics of the CBVE instructional delivery systems as they exist in the area vocational-technical schools in Oklahoma?

The subjects of this study were administrators and instructors of the area vocational-technical schools of Oklahoma. Questionnaires were mailed to administrators in 50 area schools. Administrators from 47 of the 50 schools completed and returned questionnaires. A total of 547 questionnaires were mailed to instructors selected from a population of 820 area school instructors. Instructors completed and returned 314 questionnaires.

The administrator questionnaire was designed to collect CBVE data, and to request administrators identify instructors who were using CBVE in at least 20 percent of their instructional materials. The instructor questionnaire has four main sections: a section to collect instructional delivery systems data, two sections to collect data about the extent to which CBVE had been implemented in the area schools, and a section to collect personal data.

The review of literature was divided into three major areas; a discussion of competency-based vocational education, a discussion of instructional delivery systems, and a discussion of competency-based vocational education and mastery learning as complementary or conflicting units of curriculum design.

Summary

Research indicated that CBVE is a well established system for collecting and selecting performance objectives for use in developing a course of instruction; however, little is said about the actual presentation or delivery of these course materials to the learner. A detailed review of literature indicated that the two most effective instructional delivery systems for competency-based education were Bloom's Learning for Mastery and Keller's Personalized System of Instruction. These two learning systems are individually-paced, mastery learning systems, based on performance objective. Individually-paced instruction can operate as group-paced, teacher-paced, computer-paced or self-paced instruction. A review of literature indicated that teacher-pace, group-paced and computer-paced instruction were superior and equally effective instruction management methods. Computer-paced

along with its superior rating also has a time savings of 33 percent. The same review of literature also clearly indicated that self-paced instruction was the least efficient instruction management method. The review also indicated an overall superior rating for individually-paced instruction as compared to conventional lock-step instruction.

As an analysis, collected data was compared with research data. In implementing CBVE, school personnel reported a mean score of 3.10 on a five point Likert scale, with 4.0 as fully implemented. The collected data on instructional delivery systems was compared with the analysis guide for instructional delivery systems and the check list with questions for evaluating CBVE instructional delivery systems. The collected data received a mean score of 64.6 on a 100 point rating scale. It was concluded that CBVE was well established in the area schools of Oklahoma, however, the delivery systems were found to use only 65 percent of what research indicated were the most effective elements of a mastery learning instructional delivery system.

Conclusion

Conclusions from this research are:

1. From a meta-analysis and experts in the field it was concluded that he most effective mastery learning instructional delivery systems were Bloom's Learning for Mastery and Keller's Personalized System of Instruction. These two learning systems are individually-paced, mastery learning systems, based on performance objective.

2. Meta-analysis is a well accepted method of statistical analysis for integrating the findings of a collection of individual studies on a specific subject, as indicated by a review of literature.

3. Individually-paced instruction can operate using group-paced, teacher-paced, computer-paced or self-paced instruction, as indicated by a review of literature.

4. A review of literature revealed that computer-paced, teacher-paced, and group-paced instruction were superior individually-paced systems.

5. A review of literature indicated that self-paced instruction was the least effective individually-paced system.

6. A review of literature revealed that overall individually-paced instruction was rated superior as compared to conventional lock-step instruction.

7. Competency based vocational education is a well established system for collecting and selecting performance objectives for use in a course of instruction, as indicated by a review of literature.

8. A review of literature indicated that in most CBVE systems, little is said about how instruction should be structured for the actual presentation or delivery to the student.

9. Develop a Curriculum (DACUM) is the most efficient method of determining occupational curriculum content, as indicated by a review of literature.

10. With a rating of 3.10 on Likert scale and with 4.0 as fully implemented it was concluded that competency-based vocational education was well established in the area schools of Oklahoma.

11. The collected data from this project when compared to the analysis guide and evaluation check list received only 64.6 points on a 100 point scale. It was, therefore, concluded that the instructional delivery systems of the programs participating in this research project

were using only 65 percent of what research indicated were the most effective elements of a mastery learning instructional delivery system.

Recommendations

This study has provided information concerning the most effective CBVE instructional delivery systems. The information presented in this study should be useful to curriculum development personnel, administrators, and teacher educators, but most importantly to the instructor whose job it is to present course materials to the learner.

The following recommendations are offered:

1. The results of this study and future studies on CBVE instructional delivery systems should be made available to all vocational personnel.

2. Instructional technology is the study of individually-paced instruction, mastery learning, computer based learning and visual based instruction. Therefore, the college of education should add "Instructional Technology" as an area of specialization, similar to University College Open University, which is a part of Cambridge University, in Great Britain.

3. All divisions of vocational teacher education should change their upper division courses to include more of the study of instructional technology.

4. Vocational education should include instructional technology as a teacher certification requirement.

5. A division titled "Instructional Technology" should be established as part of the curriculum development services at the Oklahoma Department of Vocational-Technical Education.

6. The Oklahoma Department of Vocational-Technical Education should consider developing computer managed instruction and computer-paced instruction for use in all Oklahoma Vocational-technical programs.

7. All future audio-visual course development should be based on Postlethwait's Audio-Tutorial method of instructional delivery, as identified by a review of literature.

8. The check list with questions for evaluating instructional delivery systems and the analysis guide for instructional delivery systems, both developed in this study, should be adapted for use by administrators and instructors as an aid to future curriculum development efforts.

9. All schools or instructors who prefer instructor delivery as a primary method of instruction should adopt Bloom's Learning for Mastery and use group-paced/individually-paced instruction.

10. All schools or instructors who prefer an open-entry/open-exit method of instruction should adopt Keller's Personalized System of Instruction.

The following recommendations are offered for future study:

1. The instructional delivery systems for all programs and all instructors should be the subject of a future study.

2. Field test to further refine the check list with questions for evaluating CBVE instructional delivery systems and the analysis guide for instructional delivery systems.

3. In Oklahoma area schools only 12 schools have a full time curriculum development specialist. It is recommend a research project be established to check the quality of the programs that have a full time curriculum specialist as compared to those who do not.

REFERENCES

Ary, D., Jacobs, L., & Razauieh, A. (1972). Introduction to Research in Education. New York: Holt, Rinehart & Winston.

Bangert, R. L., Kulik, J. A., & Kulik, C. L. (1983). Individualized Systems of Instruction in Secondary Schools. Review of Educational Research, 53(2), 143-158.

Bangert-Downs, R. L. (1985). Meta-Analysis of Findings on Computer-Based Education with Precollege Students. American Educational Research Association, Chicago, IL.

Blank, W. E. (1987). A Statewide System for Competency-Based Instruction. Journal of Industrial Teacher Education, 24(4), 36-46.

Block, J. H., Burns, B. B. (1976). Mastery Learning, In L. S. Shulman (Ed.), Review of Research in Education, 4, 3-49.

Block, J. H., Efthim, H.E., & Burns, R. B. (1989). Building Effective Mastery Learning Schools. New York: Longman.

Bloom, B.S. (1968). Mastery Learning: Evaluation Comment. Los Angeles: UCLA Centre for the Study of Instructional Programs, 1(2), 1-12.

Bloom, B.S., Madaus, G.F., & Hastings, J.T., (1981). Evaluating to Improve Learning. New York: McGraw-Hill.

Bolding, J. (1984). Statistics with Finesse [Computer Program]. Fayetteville, AR.

Bond, D.J. (1985). Individualized Instruction in Higher Education. In T. Husen (Ed.), The International Encyclopedia of Education. (pp. 2451-2457). Oxford: Pergamor.

Borg, W. R., Gall, M. D. (1983). Educational Research, (4th ed). New York: Longman.

Buttram, J. L. (1987). An Evaluation of Competency-Based Vocational Education in Pennsylvania: Five Years Later, Journal of Vocational Education Research, 12(4), 35-55.

Buttram, J., Kershner, K., & Dusewicz, R. (1985). Evaluation of Competency-Based Vocational Education. Philadelphia: Research for Better Schools.

Campbell, C.P. (1984). Procedures for Developing and Evaluating Vocational Training Programs. Journal of Industrial Teacher Education. 21(4) 31-42.

Carrol, J. B. (1963). A Model for School Learning. Teachers College Record, 64, 723-733.

Catalog of Competency-Based Vocational Instructional Materials. (1988). Stillwater, OK: Mid-America Vocational Curriculum Consortium.

Cook, D., LaFleur, N.(1975). A Guide to Educational Research. Boston: Allyn and Bacon, Inc.

Curriculum Terminology. (1982). East Central Network for Curriculum Coordination, Springfield, IL.

Douglass, R. S. (1984). The 1984 V-TECS Organizational Structure and Membership Options Study, Springfield, IL: East Central Network for Curriculum Coordination.

Douglass, R., Patton, R. (1988). The Progress of the Technical Committees. Vocational Education Journal. 12(2) 26-29

Developing a Unit of Instruction. (1985). Stillwater, OK: Mid-America Vocational Curriculum Consortium.

Dunkin, M., Barnes, J. (1986). Research on Teaching in Higher Education. In Whittrock, M. C., (ed.), Handbook of Research of Research on Teaching, (3rd ed). (pp. 758). New York: MacMillan.

Elias, J. L., Merriam, S. (1980). Philosophical Foundations of Adult Education. Malabar, Florida: Robert E. Krieger.

Elsworth, G., Gilding, T., & Hall, K. (1984). Computer Managed Learning in Technical and Further Education: An Evaluation Report. Melbourne: Centre for Program Evaluation, Melbourne College of Advanced Education.

Evans, R.M., Braby, R. (1983). Self-Paced and Conventional Instruction in Navy Training: A Comparison of Elements of Quality. Technical Report 147, Orlando, Fl: Naval Training Analysis and Evaluation Group.

Finch, C. R., Crunkilton, J. R. (1989). Curriculum Development in Vocational and Technical Education. Boston: Allyn and Bacon.

Finch, C. R. (1987). Instructional Systems Development in the Military, Journal of Industrial Teacher Education. 24(4), 18-26.

Finch, C.R. (1982). Trade and Industrial Education. In H.E. Mitzel, (ed). The Encyclopedia of Educational Research (5th ed). (pp. 1937-1947). New York: McMillian.

Finch, C.R., Falls, S.S. (1982). Functional Context Methods of Instruction in the Military. Journal of Industrial Teacher Education. 20(1) 60-71.

Freda, J. (1982). Relationships Among Student Ability, School Performance, and Fleet Supervisor Rating for Navy "A" School Graduates. TAEG-TR-136, Orlando, FL: Naval Training Analysis and Evaluation Group.

Fryklund, V. C. (1970). Occupational Analysis. New York: Bruce and Glencoe.

Gagne, R. M. (1985). The Conditions of Learning (4th ed). New York: Holt, Rinehart and Winston.

Gagne, R. M., Briggs, L. J. (1979). Principles of Instructional Design. (2nd ed). New York: Holt, Rinehart and Winston.

Gagne, R. M., Briggs, L. J., & Wagner, W. W. (1988). Principles of Instructional Design. (3rd ed). New York: Holt, Rinehart and Winston.

Glass, G. V., McGaw, B., & Smith, M. L. (1981). Meta-Analysis in Social Research. Beverly Hills: Sage.

Glass, G. V. (1976). Primary, Secondary, and Meta-Analysis of Research. Educational Researcher, 5, 3-8

Guskey, T. R. (1985b). Implementing Mastery Learning. Belmont, California: Wadsworth.

Guskey, T. R., Gates, S. L. (1985a). A Synthesis of Research on Group-Based Mastery Learning Programs, American Educational Research Association, Chicago, IL.

Hall, E. R., Freda, J. S. (1982). A Comparison of Individualized and Conventional Instruction in Navy Technical Training. Technical Report 117, Orlando, FL: Training Analysis and Evaluation Group.

Harris, R., Barnes, G., Haines, B., & Hobart, B. (1984). Competency Based Vocational Education: an Evaluation. Adelaide: TAFE National Centre for Research and Development.

Harris, R., Schutte, R. (1984). A Review of Competency-Based Occupational Education. Adelaide: Adelaide College of Advanced Education.

Hartley, S. (1977). Meta-analysis of the Effects of Individually-Paced Instruction in Mathematics. Dissertation Abstracts International, 38(7-A), 4003.

Interactive Video Volume One. (1989). Englewood Cliffs, NJ: The Educational Technology Anthology Series.

Jaccard, J. (1983). Statistics for the Behavioral Sciences. Belmont, CA: Wadsworth.

Johnson, K. A. (1982). An Evaluation of Individualized, Job-Specific Maintenance Training, NPRDC-TR-82-53, San Diego, CA: Navy Personnel Research and Development Center.

Keller, F., (1968). "Good-Bye Teacher..." Journal of Applied Behavior Analysis, 1, 79-89.

Keller, F., Sherman, J. (1974). The Keller Plan Handbook. Menlo Park, CA: W. A. Benjamin, Inc.

Key, J. P. (1974). Research Design. Stillwater, OK: Oklahoma State University.

Knirk, F.G., Gustafson, K.L. (1986). Instructional Technology. New York: CBS College

Koen, B., Jensen, P., & Roth, C. (1985). The Keller Plan: A Successful Experiment in Engineering Education. Engineering Education, 2(85), 280-284.

Kulik, J.A., Kulik, C.L., & Cohen, P.A. (1979a). A Meta-Analysis of Outcome Studies of Keller's Personalized System of Instruction. American Psychologist, 34, 307-318.

Kulik, J.A., Kulik, C. C., & Cohen, P. (1979b). Research on Audio-Tutorial Instruction: A Meta-Analysis of Comparative Studies. Research in Higher Education. 11: 321-341.

Kulik, J.A., Cohen, P.A., & Ebbling, B.J. (1980a). Effectiveness of Programmed Instruction in Higher Education: A Meta-Analysis of Findings. Educational Evaluation and Policy Analysis, 2(6), 51-64.

Kulik, J.A., Kulik, C.L., & Cohen, P.A. (1980b). Effectiveness of Computer-Based College Teaching: A Meta-Analysis of Findings. Review of Educational Research, 50(4), 525-544.

Kulik, J. A. (1982). Individualized Systems of Instruction. In H.E. Mitzel (Ed.), The Encyclopedia of Educational Research (5th ed.). (pp. 851-858). New York: MacMillan.

Kulik, J. A. (1984). The Fourth Revolution in Teaching: Meta-Analysis. American Educational Research Association, New Orleans, LA.

Kulik, J. A. (1985a). Keller Plan: A Personalized System of Instruction. In T. Husen (Ed.), The International Encyclopedia of Education. (pp. 2798-2803). Oxford: Pergamor.

Kulik, C. C. (1985b). Effectiveness of Computer-Based Adult Education. American Educational Research Association, Chicago, IL.

Kulik, J. A. (1985c). Consistencies in Findings on Computer-Based Education, American Educational Research Association, Chicago, IL.

Kulik, C. C. (1985d). Effectiveness of Computer-Based Education in Colleges, American Educational Research Association, Chicago, IL.

Kulik, C. C. (1986). Effects of Testing for Mastery on Student Learning. American Educational Research Association, New Orleans, LA.

Mager, R. F., Beach, K. M. (1967). Developing Vocational Instruction. Belmont, California: Fearon.

MAVCC. (1989). Catalog of Competency-Based Vocational Instructional Materials. Stillwater, OK: Mid-America Vocational Curriculum Consortium

McGaw, B. (1985). Meta-Analysis. In T. Hussen (Ed.), The International Encyclopedia of Education. (pp. 3322-3330). Oxford: Pergamor.

Melton, R. J. (1981). Individualized Learning Methods in Perspective. Higher Education, 10, 403-423.

Mevarech. Z.R. (1983). The Role of Feedback-corrective Procedure in Developing psychomotor Application Skills. The Journal of Vocational Education Research. 8(2) 22-32.

Meyer, C. F. Benson, R. T. (1985). V-TECS Guide for Electronics Mechanic. Columbia, SC: South Carolina Department of Education.

Micheli, G. S., Ford, L. H. (1983). Survey of the Extent of Individualized Instruction in Navy "A' and "C" School Courses, Technical Memorandum 83-7, Orlando, FL: Naval Training Analysis and Evaluation Group.

Miller, M. D. (1985). Principles and a Philosophy for Vocational Education. Columbus, Ohio: The National Center for Research in Vocational Education.

Morris, E.K., Surber, C.F., & Bijou, S.W. (1978). Self-Pacing Versus Instructor Pacing: Achievement, Evaluation, and Retention. Journal of Educational Psychology. 70(2) 224-230.

NAVEDTRA 106A. (1975). Interservice Procedures for Instructional Systems Development.

Norton, R. E. (1985). DACUM Handbook. Columbus, Ohio: The National Center for Research in Vocational Education.

Orr, E. E. (1988).Education Specialist, Naval Air Technical Training Center, Memphis, Tenn., Personal Interview, July 27, 1988.

Otto, H. J. (1950). Elementary Education, In H.E. Mitzel (Ed.), The Encyclopedia of Educational Research (2nd ed.). (pp. 428-446). New York: MacMillan.

Over, R., Lancaster, S. (1985). Meta-Analysis in the behavioral Sciences: A Selected Bibliography. Professional Psychology Abstracts. (pp 2-7).

Owens, E. (1988). Deputy Assistant Chief of Staff, Naval Technical Training, Memphis, Tenn., Personal Interview, July 27, 1988.

Pearson, M. (1983). Approaches to Individualizing Instruction - A Review. Higher Education Research and Development. (pp. 155-181).

Percival, F., Ellington, H. (1988). A Handbook of Educational Technology. (2nd ed). London: Kogan Page.

Perry, W. G., (1982). How to Develop Competency-Based Vocational Education. Ann Arbor, Michigan: Prakken.

Peters, R. (1987). Preparing for the Future, Strategic Plan for Vocational and Technical Education in Oklahoma, Stillwater, OK: State Department of Vocational and Technical Education.

Popham, W. (1973). The New World of Accountability: In the Classroom, In J. DeCarlo and C. Mason (eds.), Innovations in Education for the Seventies: Selected Readings. New York: Behavioral Publications.

Postethwaite, S. N. Novak, J. Murray, H. T. (1972). The Audio-Tutorial Approach to Learning. Minneapolis: Burgess.

Pucel, D. J., Knaak, W. C. (1975). Individualizing Vocational and Technical Instruction. Columbus, Ohio: Merrill.

Pucel, D. J. (1987). Incorporating Affective Skills into Performance-Based Vocational Education and Industrial Training. Mid-America Conference for Vocational Technical Education. St. Paul, MN.

Pucel, D. J. (1989). Performance-Based Instructional Design. New York: McGraw-Hill.

Reynolds, A. (1983). An Introduction to Computer-Based Learning. In L. Baird (ed.) The Training and Development Source Book, (pp. 153-158). Amherst, Mass: Human Resource Development Press.

Sherman, J., Ruskin,R., and Semb, G. (1982). The Personalized System of Instruction: 48 Seminal Papers. Lawerence, Ks: TRI Publications.

Skinner, B. F. (1968). The Technology of Teaching. New York: Appleton-Century Croft.

Skutack, D. E. (1980). A Catalog of Performance Objectives, Performance Guides, Tools and Equipment for Electronics Mechanics. Atlanta: V-TECS

Spencer, K. (1988). The Psychology of Educational Technology and Instructional Media. London: Routledge.

State of Florida. (1985). Barriers to Implementing Competency-Based Vocational Education in Postsecondary Schools. Division of Vocational, Adult, and Community Education, Tallahassee, (pp. 5-6).

Stowers, M. P., Tessmer, M. (1986). Self-Paced Instruction, New Directions for Higher Education, 56, 17-25.

Suzuki, W. N., Finch, C. R. (1987). Alternate Delivery Systems: Critique and Comment. Journal of Industrial Teacher Education, 24(4). 52-55.

Technical Reference Manual for Development of V-TECS Guides. (1983). Atlanta: V-TECS.

Thomas, R.M. (1985). Individualized Instruction. In T. Husen (Ed.), The International Encyclopedia of Education. (pp. 2446-2451). Oxford: Pergamor.

Thompson, J. (1985). Individualized Systems of Instruction in TAFE College. Payneham, Australia: TAFE National Centre for Research and Development.

Van Dalen, D. (1979). Understanding Educational Research, An Introduction. (4th ed). New York: McGraw-Hill.

Vocational-Technical Terminology. (1971). Washington, D.C.: American Vocational Association.

V-TECS Catalog. (1989). Competency-Based Vocational-Technical Education, Vocational-Technical Education Consortium of States, Macomb, IL: Curriculum Publications Clearinghouse.

Vo-Tech Personnel Directory-Year 88-89. (1988). Stillwater, OK: Oklahoma Department of Vocational and Technical Education.

Wadsworth, B. J. (1984). Piaget's Theory of Cognitive and Affective Development. (3rd ed). New York: Longman.

Weber, J. M., Puleo, N. F. (1988). Dynamics of Secondary Programs. Columbus, Ohio: The National Center for Research in Vocational Education.

Whipple, G.M. (1925). Adapting the Schools to Individual Differences. In: Twenty-Fourth Yearbook of the National Society for the Study of Education. Chicago: Society for the Study of Education.

Wisniewski, A. (1988). Senior Education Specialist, Naval Air Technical Training Center, Memphis, Tenn., Personal Interview. July, 27, 1988.

Zajkowski, M. M., Heidt, E. A., Corey, J. M., Mew, D. V., & Micheli, G. S. (1979). An Assessment of Individualized Instruction in Navy Technical Training. TAEG Technical Report 78, Orlando Fl: Training Analysis and Evaluation Group.

APPENDIXES

APPENDIX A

ADMINISTRATOR QUESTIONNAIRE

1. Competency Based Vocational Education (CBVE) programs.

   A. Name of School _____

   B. Is your school presently using CBVE?

      YES NO Comment:

2. If yes, how long has your school used CBVE?

      _____ years Comment:

   A. Does your school employ a fully time curriculum development specialist

      YES NO Comment:

   B. Does your school maintain a verified competency/task list for each program using CBVE?

      YES NO Comment:

   C. In which of the following vocational programs has your school implemented or are in the process of implementing CBVE? (check all that apply)

      ___ Agriculture
      ___ Business and Office
      ___ Marketing
      ___ Health
      ___ Home Ec/Consumer Ed
      ___ Special Ed Programs
      ___ Trade and Industrial
      ___ Other

3. Please list the programs and instructors at your school who are using CBVE in at least 20% of their course materials, and that have your permission to participate in a survey on CBVE.

Program	Instructor

(over)

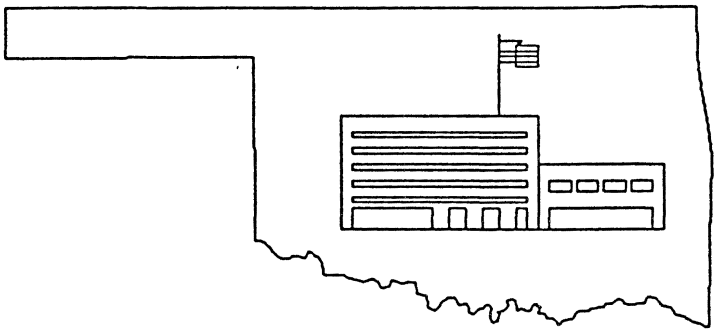
Program _____ Instructor _____

APPENDIX B

INSTRUCTOR QUESTIONNAIRE

COMPETENCY BASED VOCATIONAL EDUCATION

TEACHER SURVEY



Oklahoma State University

Department of Occupational and Adult Education

SECTION 1: The following items refer to instructional delivery systems. Please read each item and place a check (√) in the space by the appropriate answer or fill in the blank. If you are uncertain as to the answer, please place a check by **Unknown**.

1. a. Is your course divided into units of instruction?
   ____ Yes
   ____ No
   ____ Unknown

   b. If yes, the units are called:
   ____ LAPs
   ____ Modules
   ____ Study Guides
   ____ Other (specify): _____

2. Is there more than one parallel examination for each unit of instruction?
   ____ Yes
   ____ No
   ____ Unknown

3. Is a multimedia choice of study materials available for most units of instruction (i.e., video tape or sound/slides)?
   ____ Yes
   ____ No
   ____ Unknown

4. What percentage of your program is individually-paced instruction?
   ____%
   ____ Unknown

   Comments: _____

   _____

5. What is the completion time, in class hours, for an average sized unit of instruction in your course?
   ____ Hours
   ____ Unknown

   Comments: _____

   _____

6. Does your course have review units at specific intervals (i.e., after every two or three units)?
   ____ Yes
   ____ No
   ____ Unknown

   Comments: _____

   _____

7. What is the minimum passing grade for each unit test or quiz?
   ____%

   Comments: _____

   _____

8. What is the average length of time it takes for feedback of test results to reach students in your courses?
   ____ 10 minutes or less
   ____ 11 to 30 minutes
   ____ 31 to 60 minutes
   ____ 61 minutes to 3 hours
   ____ 24 hours
   ____ Other (specify): _____

   Comments: _____

   _____

9. Do you use mid-term and /or final exams in your course?
   ____ Yes
   ____ No
   ____ Unknown

   Comments: _____

   _____

10. Do you use criterion-referenced testing in your course?
    ____ Yes
    ____ No
    ____ Unknown

    Comments: _____

    _____

11. Do you use diagnostic testing to provide feedback and to prescribe remedial instruction for each unit?
    ____ Yes
    ____ No
    ____ Unknown

    Comments: _____

    _____

12. a. Do you use the state curriculum in teaching your course?
    ____ Yes
    ____ No
    ____ Unknown

    b. If yes, for what percentage of the course do you use this curriculum?
    ____%

    Comments: _____

    _____

SECTION 2: The following five questions relate to the scope of your course. Please read each item and place a check (√) in the blank by the appropriate response.

1. The title of your course is defined by the "Dictionary of Occupational Titles (D.O.T.) by code and title.
    ____ Yes
    ____ No
    ____ Unknown

2. The course description written for your vocational program is based on the D.O.T..
   ____ Yes
   ____ No
   ____ Unknown

3. The course description written for your vocational program is verified by an advisory committee.
   ____ Yes
   ____ No
   ____ Unknown

4. Employment opportunities for students in your vocational program are projected for 3-5 years from labor market data and advisory committee feedback.
   ____ Yes
   ____ No
   ____ Unknown

5. Anticipated technological changes in your occupation are determined from industry and advisory committee feedback.
   ____ Yes
   ____ No
   ____ Unknown

SECTION 3: Indicate the extent to which each of the following elements have been implemented in your vocational program by circling the number in the appropriate column. If you are unable to respond to an item, circle the U in the column marked **Unknown**.

A. Validate Occupational Competencies	Fully Implemented	Moderately Implemented	Minimally Implemented	Not Yet Implemented	Unknown
1. Verified competency lists were reviewed by instructor(s) to identify occupational tasks for vocational program.	4	3	2	1	U
2. A task analysis was developed by instructor to identify occupational tasks for vocational program where none were available.	4	3	2	1	U
3. Occupational tasks for vocational program were reviewed and approved by advisory committee based upon industry needs.	4	3	2	1	U

	Fully Implemented	Moderately Implemented	Minimally Implemented	Not Yet Implemented	Unknown
B. Identify Valid Terminal Performance Objectives for Each Task					
4. Performance objectives from appropriate competency lists identified and reviewed.	4	3	2	1	U
5. Performance objectives written for tasks where none are available.	4	3	2	1	U
6. Performance objectives reviewed by advisory committee to determine validity of conditions, performance, and standards.	4	3	2	1	U
C. Identify Sequential Performance Steps for Each Task					
7. Performance guides in existing competency lists reviewed for content and sequence.	4	3	2	1	U
8. Performance steps written and sequenced for tasks where none were available.	4	3	2	1	U
9. Performance steps and sequence for all identified tasks reviewed and approved by advisory committee.	4	3	2	1	U
D. Determine Resources Required to Perform Tasks					
10. Competency tool and equipment lists analyzed for application to task performance.	4	3	2	1	U
11. Additional tools and equipment identified for tasks.	4	3	2	1	U
12. Classroom and laboratory requirements identified and documented.	4	3	2	1	U
13. Reference materials identified for each task.	4	3	2	1	U
14. Finalized resource list reviewed and approved by advisory committee.	4	3	2	1	U
E. Determine Required Task Sequence					
15. Determine sequence of task from competency lists.	4	3	2	1	U

	Fully Implemented	Moderately Implemented	Minimally Implemented	Not Yet Implemented	Unknown
16. Determine sequence of tasks developed by instructor.	4	3	2	1	U
F. Assess Student Performance for Each Objective					
17. Tests constructed for each performance objective based upon established standards.	4	3	2	1	U
18. A system to convert performance on objectives to a conventional grading scale is in place and known to students.	4	3	2	1	U
G. Identify Instructional Program Contents for Each Student					
19. Tentative career goals identified and documented for each student.	4	3	2	1	U
20. Students entry level skills assessed to determine initial instructional placement in program.	4	3	2	1	U
H. Design a Learning Management System					
21. A manual system developed to monitor progress and provide feedback information to students.	4	3	2	1	U
22. Computer Managed Instruction developed to monitor progress and provide for continuous feedback to students.	4	3	2	1	U
I. Conduct Course Evaluation					
23. On-the-job performance of graduates assessed through employer feedback via local surveys.	4	3	2	1	U
24. Student course completion questionnaires, follow-up data, and advisory committee feedback compiled for use in course revision.	4	3	2	1	U

Please go on to the next page

SECTION 4: In order to make this information more meaningful, please provide the following information about you and your program.

Name of school:_____

Vocational program area:_____

Number of years vocational teaching experience:_____

Number of years industrial experience:_____

Number of years using competency based vocational education:_____

Thank you for taking the time to complete this survey. Your input will be of great use in this study. Please use the space below to provide any additional data concerning competency based vocational education which you would like to make.

_____

_____

_____

_____

_____

_____

APPENDIX C

ADMINISTRATOR COVER LETTER

OSU

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION
COLLEGE OF EDUCATION

STILLWATER, OKLAHOMA 74078-0406
CLASSROOM BUILDING 406
(405) 744-6275

August 8, 1989

Dear Administrator:

We are conducting a survey on the state-wide implementation of competency-based vocational education (CBVE). As a part of this effort, we are surveying a sample of administrators, like you, who are responsible for the vocational curricula at their respective schools.

The results of this study will be used to update the vocational teacher education programs in Oklahoma; therefore, please respond to the survey as accurately and as completely as possible. Answer each item based on your own personal involvement and participation in relations to the vocational programs at your school.

All responses will be kept anonymous and reported only in aggregate form. If you have any questions, you may contact Dr. Clyde B. Knight at Oklahoma State University (405) 744-6275, or Jim Jent (918) 540-2040. Thank you for your most important input and assistance.

Respectfully,

Jim Jent

Clyde B. Knight

JJ:mkr

Enclosure

CENTENNIAL
1890 • 1990

Celebrating the Past . . Preparing for the Future

APPENDIX D

INSTRUCTOR COVER LETTER

OSU

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION
COLLEGE OF EDUCATION

STILLWATER, OKLAHOMA 74078-0406
CLASSROOM BUILDING 406
(405) 744-6275

August 28, 1989

Dear Instructor:

We are conducting a survey on the state-wide implementation of competency-based vocational education (CBVE). As a part of this effort, we are surveying a sample of teachers, like you, who are involved in the implementation of CBVE at their respective schools. You have been selected by your administrator as one who can be most helpful.

The results of this study will be used to update the vocational teacher education programs in Oklahoma, therefore, please respond to the survey as accurately and as completely as possible. Answer each item based on your own personal involvement and participation in relation to your vocational program. All responses will be kept anonymous and reported only in aggregate form.

If you have any questions, you may contact Jim Jent at (918) 540-2040. Thank you for your most important input and assistance.

Respectfully,

Jim Jent

Clyde B. Knight

JJ:mkr

Enclosure

CENTENNIAL
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Celebrating the Past . . . Preparing for the Future

APPENDIX E

QUESTIONNAIRE COMMENTS

QUESTIONNAIRE COMMENTS

1. "I feel very strongly that I have an excellent program and graduates of my banking course have been very successful. I have made up my own packets and written my own study guides, which are revised continuously. I have participated in writing curriculum for the state and compiling competency lists and tests." (B&O)

2. "In the business area there are a great many books to provide learning units so I have not developed LAPS." (B&O)

3. "Banking is a course that has to have the interaction of the student in role-play. It can not be totally individualized." (B&O)

4. "Most of the task analysis information is from the State Department of VO-TECH. I have not done task analysis research." (B&O)

5. "Many lessons are assigned with oral instructions to encourage students to develop listening skills/or communication skills in asking for assistance. As technology changes so quickly in this field competencies are frequently updated. As each class is different, assignments are planned (not necessarily lowered) according to class ability." (B&O)

6. "Well constructed survey" (B&O)

7. "It will be interesting to see how well competencies are coordinated between all of the VO-TECH instructors in business and office when the time comes to do so. The coordination of material taught, material source, and testing will definitely be mind boggling." (B&O)

8. "I think this type of vocational education (CBVE) works better with adults. I don't think secondary students for the most part are mature enough to handle this type of education. I find my adults respond better to this type of education." (B&O)

9. "CBE need additional job and training task analysis of future job, not what industry is currently doing which is yesterday's technologies." (B&O)

10. "I am a firm believer in competency based individualized instruction. It works!! come visit our program." (B&O)

11. "You can do all this stuff - then your students aren't as competent as the old schools - for instants the old 3 year diploma nursing program, basic ed. 30 years ago, etc." (Health)

12. "Competency based education is the only way an instructor can be sure the student/graduate has the skills necessary to perform the job. It also improves the student's self-confidence because they know where they stand with the skills learned. The adult students I teach like the objectives/competencies based instructional method." (Health)

13. "Please let me know if you need an outline of the curriculum or copies of my competencies." (Health)

14. "The new texts in my field are written in the competency-based mode. Our national organization has done a process analysis I use as well as local input." (Health)

15. "Our course description and objectives are drawn up to meet the objectives of the Nurse Practice Act of Oklahoma." (Health)

16. "Thank you" (Health)

17. "The competency based materials work very well for adult students and high school students that are self-motivated. I have not had much success with the materials when used with a student with a learning disability." (Home Economics)

18. "I feel a student should have one of two certificates when they leave school. One to show they completed the class (like attendance) the other is for skills they can perform." (Home Economics)

19. "Security guard education is based on state law and administered by CLEET (Council on Law Enforcement and Education)." (Marketing)

20. "I don't believe this is intended for marketing." (Marketing)

21. "LAPs don't work with most of my students in Bldg& Grds but I used them faithfully when teaching diesel mechanics." (Special Programs)

22. "There is a revolution in education taking place. My advisory committee and the contacts that I make during industry visits confirm this. Industry is looking for people that can do, not just talk about it. The trend is moving away from formal education and toward "hands-on" training. Competency-based, self-paced training will prove to be a valuable adjunct to formal education in the future." (T&I)

23. "The masonry program is setup with training modules in the shop area and students rotate through various training exercises using the modules and sketches of jobs to be done. The competency's are accomplished through this method." (T&I)

24. "CBVE will only work with the student that you get out of high school that can read and write. Students with a reading, writing and math skills above the 4th or 5th grade level. You keep wanting us to water down the program to fit this type of student, so that they will not fail. Sooner or later you are going to have to make public education answer for what they are not accomplishing before we get them." (T&I)

25. "This kind of instruction works very well with adult students, it does not work as well with high school students. Most HS students are not motivated enough to complete the materials on their own. HS students have to have very close supervision to complete the requirements, I find it more trouble than it's worth, with HS students." (T&I)

26. "I presently teach adult students only. However, the first year I taught, I had both adult and high students. I think CBVE is great for adult students. My experience with high school students and CBVE was not as positive." (T&I)

27. "I do not like competency based materials." (T&I)

28. "We are just getting started using individualized instruction methods. I feel competency-based education is the best instruction for most students. I will move more in this direction next year." (T&I)

29. "Great for the student, tremendous work for the instructor." (T&I)

30. "It (CBVE) is a good supplement but should not be considered as the main teaching tool in a hand skill craft." (T&I)

31. "The competency-based system is ideal for open-entry classes. Adults operate very well on this system. High school students have to be continuously monitored the first year of the system." (T&I)

32. "This is a real headache fore the teacher. It really helps the student in an open-entry open-exit situation." (T&I)

33. "This is an all adult, open-entry open-exit program. State curriculum, competency profiles are used for each student. Both are very helpful with the way students enter and leave this program." (T&I)

34. "The aviation maintenance technician class has always been competency-based. This has always been a requirement of the FAA. They also control our curriculum." (T&I)

35. "I developed my own curriculum which is competency-based by using the state curriculum and other materials. I am 60 percent finished with my curriculum and will hopefully finish the other 40 percent by the end of the 90 school year." (T&I)

36. "Since no two individuals are the same, I have found that a competency must be taught in such a way as to fit the individual's personal learning pattern. This is to say no method, sequence or diagnostic test can be used for all students nor can all students be expected to achieve all competencies at the same rate or in the same way." (T&I)

37. "I don't believe anyone can teach very well without some type of organizational method of preparation, presentation, testing and evaluation of programs. Another important factor for any program is the support of the administration, student selection and finances." (T&I)

38. "I think that if were not careful, in the future the clamor for 'education reform', that we will be trying to teach 'hi-tech' to students that have never had the 'basics'. This is partly what is wrong with our high school students, today, who can't read and do simple math problems." (T&I)

39. "We utilize on the job experiences and on the job training to fully develop competencies with our students. By not constructing a project house this is the way we use to obtain 'real world' experiences." (T&I)

40. "We have been using competency-based vocational education for several years, but not the state CBVE." (T&I)

41. "I am at this time, well pleased with competency based vocational education." (T&I)

42. "It works best for students who are self-motivated." (T&I)

43. "Competency-based education, I believe should be installed in all school systems for the simple fact students are walking out of our schools uneducated because they almost meet minimum standards." (T&I)

44. "It is my opinion that self-paced curriculum is the absolute worst kind of instruction mode for high school children." (T&I)

45. "You cannot pass someone or give them credit for a program and then turn around and say their not competent. In other words, give someone a 'D' with an average of 68 percent and say 80 percent is competency in this program. When we do that we are guilty of the same thing we accuse others of, passing them through the system. That would be the same as getting a M.D. degree, but not qualified to practice medicine." (T&I)

46. "NATEF (ASE) has developed additional materials to help evaluate each students development throughout the training program, which would be transferable to any other program if the student transferred in mid-school year. It would also be excellent to add to a resume." (T&I)

47. "We have to much paper work that takes away from the students already, competency based data is too long. Also this survey is too long, I had to stop to finish class." (T&I)

APPENDIX F

PILOT STUDY RESULTS

CBVE TEACHER SURVEY
(Pilot Study)

I. Please answer the following questions. If the answer to a question is unknown please select UNKN.

A. Instructional Delivery Systems

1. Is your course divided into units of instruction; if so what do you call these units?

YES: 23
NO: 4
UNKN: 0

2. Is there more than one parallel examination for each unit of instruction?

YES: 13
NO: 13
UNKN: 1

3. Is a multimedia choice of study materials available for most units of instruction, for example video tape or sound/slides?

YES: 21
NO: 6
UNKN: 0

4. What percentage of your program is individually-paced instruction?

MEAN: 65%
UNKN: 1

5. What is the completion time, in class hours, for an average sized unit of instruction in your course?

MEAN: 85 Hours
UNKN: 5

6. Does your course have review units at specific intervals in the course, for example after ever 2 or 3 units?

YES: 12
NO: 14
UNKN: 1

7. What is the minimum passing grade for each unit test or quiz?

MEAN: 74 %

8. What is the average time for feedback of test results to reach students in your course?

1. 10 minutes or less:	6
2. 30 minutes or less:	3
3. 1 hour or less:	1
4. 3 hours or less:	1
5. By the next day:	14
6. other:	2

9. Do you use mid-term and/or final exams in your course?

YES:	19
NO:	8
UNKN:	0

10. Do you use criterion-referenced testing in your course?

YES:	18
NO:	5
UNKN:	4

11. Do you use diagnostic testing to provide feedback and to prescribe remedial instruction for each unit?

YES:	13
NO:	11
UNKN:	3

12. Do you use the state curriculum in teaching your course; if so what percentage of the course?

YES:	9
NO:	11
UNKN:	0

II. Please answer the following questions. If the answer to a question is unknown please select UNKN.

A. Define Scope of Course

1. Course title defined by the "Dictionary of Occupational Titles" (D.O.T.) by code and title.

YES:	13
NO:	5
UNKN:	9

2. Course description written for vocational program based on the D.O.T. and verified by advisory committee.

YES:	19
NO:	4
UNKN:	4

3. Employment opportunities for your vocational program are projected for 3-5 years from labor market data and advisory committee feedback.

YES:	22
NO:	3
UNKN:	2

4. Anticipated technological changes in your occupation are determined from industry and advisory committee feedback.

YES:	25
NO:	1
UNKN:	1

III. Please indicate the extent to which your vocational program has been implemented for each of the elements listed below. If the answer to a question is unknown please select UNKN.

	MEAN
A. Validate Occupational Competencies	
1. Verified competency lists were reviewed by instructor(s) to identify occupational tasks for vocational program.	2.7
2. A task analysis was developed by instructor to identify occupational tasks for vocational program where none were available.	2.7
3. Occupational tasks for vocational program reviewed and approved by advisory committee based upon industry needs.	3.0
B. Identify Valid Terminal Performance Objectives for Each Task	
4. Performance objectives from appropriate competency lists identified and reviewed.	2.9
5. Performance objectives written for tasks where none were available.	3.0
6. Performance objectives reviewed by advisory committee to determine validity of conditions, performance, and standards.	3.4
C. Identify Sequential Performance Steps for Each Task	
7. Performance guides in existing competency lists reviewed for content and sequence.	3.2
8. Performance steps written and sequenced for tasks where none were available.	2.9

	MEAN
9. Performance steps and sequence for all identified tasks reviewed and approved by advisory committee.	2.8
D. Determine Resources Required to Perform Tasks	
10. Competency tool and equipment lists analyzed for application to task performance.	2.9
11. Additional tools and equipment identified for tasks.	2.9
12. Classroom and laboratory requirements identified and documented.	2.9
13. Reference materials identified for each task.	2.6
14. Finalized resource list reviewed and approved by advisory committee.	2.1
E. Determine Required Task Sequence	
15. Determine sequence of task from competency lists.	2.9
16. Determine sequence of tasks developed by instructor.	2.8
F. Assess Student Performance for Each Objective	
17. Tests constructed for each performance objective based upon established standards.	3.4
18. A system to convert performance on objectives to a conventional grading scale is in place and known to students.	3.0
G. Identify Instructional Program Contents for each Student	
19. Tentative career goals identified and documented for each student.	3.0
20. Student entry level skills assessed to determine initial instructional placement in program.	2.2
H. Design a Learning Management System	
21. A manual system developed to monitor progress and provide feedback information to students.	2.7

	MEAN
22. Computer Managed Instruction developed to monitor progress and provide for continuous feedback to students.	1.8
I. Conduct Course Evaluation	
23. On-the-job performance of graduates assessed through employer feedback via local surveys.	2.9
24. Student course completion questionnaires, follow-up data, and advisory committee feedback compiled for use in course revision.	2.9
IV. VOCATIONAL PROGRAM DATA	
Number of years vocational teaching:	6.8
Number of years industrial experience:	15.9
Number of years you have used CBVE:	5.9

N = 27

VITA[2]

JAMES WESLEY JENT

Candidate for the Degree of

Doctor of Education

Thesis: ANALYSIS OF THE INSTRUCTIONAL DELIVERY SYSTEMS FOR COMPETENCY-BASED VOCATIONAL EDUCATION IN THE AREA VOCATIONAL-TECHNICAL SCHOOLS OF OKLAHOMA

Major Field: Occupational and Adult Education

Biographical:

Personal Data: Born in Vinita, Oklahoma, July 17, 1942, the son of Chester E. and Thelma R. Jent. Married to Gail F. Wooten August 23, 1965.

Education: Graduated from Vinita High School, Vinita, Oklahoma in May 1961; received Bachelor of Science in Industrial Psychology from University of Maryland at College Park in August, 1976; received a Master of Science in Operations Management from University of Arkansas at Fayetteville in May, 1979; completed the requirements for the Doctor of Education degree from Oklahoma State University, Stillwater, Oklahoma in May, 1990.

Professional Experience: Master Chief Avionics Technician, United States Navy, October 1961 to September 1981; Electronics Instrumentation Instructor, Moore-Norman Area Vocational Technical School, September 1981 to July 1984; Instructor and Head of Electronics and Computer Engineering Technology, Northeastern Oklahoma Agriculture and Mechanical College, Miami, Oklahoma, August 1984 to present.

Professional Organizations: American Vocational Association, Oklahoma Vocational Association, American Technical Education Association, and Oklahoma Association of Community and Junior Colleges.