DOCUMENT RESUME

ED 254 670 CE 040 901

AUTHOR Blakemore, Thomas; And Others
TITLE A Guide to Learning Style Assessment. Research and Training Center Research Report.
INSTITUTION Wisconsin Univ.-Stout, Menomonie. Stout Vocational Rehabilitation Inst.
SPONS AGENCY National Inst. of Handicapped Research (ED), Washington, DC.
PUB DATE 84
GRANT G008300117
NOTE 66p.
PUB TYPE Guides - Non-Classroom Use (055) -- Reference Materials - Bibliographies (131) -- Information Analyses (070)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Cognitive Measurement; *Cognitive Style; Cognitive Tests; Evaluation Criteria; Evaluation Methods; Evaluation Needs; Guidelines; Intelligence Tests; Literature Reviews; *Perception Tests; Postsecondary Education; *Student Evaluation; Tables (Data); Testing Problems; Test Reliability; Test Reviews; *Test Selection; Test Use; Test Validity; *Vocational Evaluation; *Vocational Rehabilitation

ABSTRACT

This manuscript was written to provide rehabilitation professionals, and vocational evaluation practitioners in particular, with information about learning style assessment instruments. The first section of the guide consists of a literature review that focuses on such aspects of development of the learning styles concept as individual differences, aptitude by treatment interactions, cognitive styles, learning styles, and learning disabilities. Discussed next are various problems and issues in the application of learning styles, including matching strategies, stability of learning styles, identifying one's own learning style, teaching and learning style congruence, and the lack of technology for matching all possible learning styles. Twelve selected learning style instruments are reviewed. The remaining three sections of the guide deal with the role of learning style in vocational rehabilitation, the benefits of learning style assessment, and the limitations of existing learning style assessment instruments. A list of references is provided. Appendixes to the guide include summaries of the 12 individual learning style instruments reviewed and purchasing information about each of the instruments. (MN)

Research Report

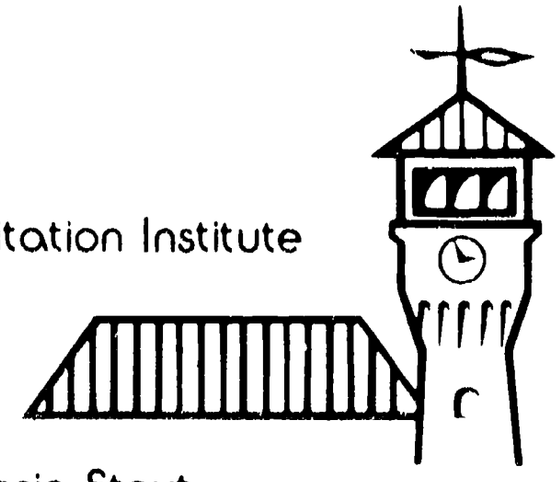
Research and Training Center

A GUIDE TO LEARNING STYLE ASSESSMENT

Thomas Blakemore, Ph.D.

Paul McCray, M.S.

Charles Coker, Ph.D.



Stout Vocational Rehabilitation Institute

University of Wisconsin-Stout

Menomonie, WI 54751

ACKNOWLEDGEMENT

Support for this research was provided to the Research and Training Center at the University of Wisconsin-Stout through Grant No. G008300117 from the National Institute of Handicapped Research. The contents do not necessarily represent the interpretation or opinion of the National Institute of Handicapped Research or The Department of Education.

RESEARCH AND TRAINING CENTER
Stout Vocational Rehabilitation Institute
School of Education and Human Services
University of Wisconsin-Stout

TABLE OF CONTENTS

PREFACE

This manuscript was written to provide rehabilitation professionals, and vocational evaluation practitioners in particular, with information about learning style assessment instruments. The need for such information has been evidenced by a growing interest in this area both within the rehabilitation and education communities, as well as a result of the development of standards by professional accrediting facilities, (CARF, 1983) which now require that client learning preferences be addressed in vocational evaluation and related service programs.

The preparation of this monograph was an initial step in a project designed to examine the utility of existing learning style assessment instruments in rehabilitation settings. The specific goals of this monograph are to: (1) review the professional resource literature concerned with learning style diagnosis and related issues; (2) describe what learning assessment instruments are and what they attempt to measure; (3) discuss the need for such instruments and how they might be used in rehabilitation; and (4) provide a detailed description of several currently available instruments.

INTRODUCTION

In recent years, the concept of "learning styles" has generated a great deal of interest in the educational community, particularly among practitioners. This is also true, although to a lesser extent, among rehabilitation professionals. The growing interest in this topic is illustrated by Semple's (1982) observation that a 1975 search of a computer data base on educational research topics found only 40 references to learning styles, whereas a similar data base search in 1979 produced over 800 titles. In rehabilitation, growing interest in this area is evidenced by the work of Rusalem and Rusalem (1976) and their Learning Capacities Projects, by the development of publications specifically concerned with this topic (McCray, 1979; Vocational Evaluation and Work Adjustment Association, 1975) and by the development of standards by the Commission on Accreditation of Rehabilitation Facilities (CARF) which now require that learning style preferences be evaluated as part of the standard vocational evaluation process.

The term learning styles has been given a variety of definitions by researchers, theorists, and instrument developers. Some of the definitions are restricted only to the factor(s) included in a specific instrument, whereas others attempt to encompass all of the definitions used by the people working in the area. Some of the definitions are explicitly stated whereas others must be inferred from the statement of the purpose of a particular instrument.

Most reviews of the learning style area have attempted to broadly define the concept so as to include all approaches. Claxton and Ralston (1978) defined learning styles as a student's consistent way of responding and

using stimuli in the context of learning. Della-Dora and Blanchard (1979) stated that learning styles is a personally preferred way of dealing with information and experience. Kirby (1979) stated that learning styles includes "not just the cognitive requirements but also students' affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment." Travers (1978) defined learning styles as "an attribute of the individual which interacts with instructional circumstances in such a way as to produce differential learning achievement as a function of those circumstances."

Dunn, De Bello, Brennan, Krimsky, and Murrain (1981) examined the differences in definitions used by several learning style instrument developers. The primary distinction between definitions that these authors made was based upon the different factors or elements included in the various learning style models. For instance, Canfield and Lafferty (1976) discussed conditions, content, modes, and expectations, whereas Dunn, Dunn, and Price (1979) discuss stimuli and elements. Dunn, et al., (1981) noted some degree of overlap among learning style definitions (models), however. For example, the element of structure is included in the models of Canfield and Lafferty, Dunn, et al, Hill (1971), and Hunt (1976). Motivational and social elements are also included in those four models. They noted that "thought processes" were also included in a number of models.

DEVELOPMENT OF THE LEARNING STYLES CONCEPT

The concept of learning styles appears to have been influenced by research and theory from both education and psychology, particularly the latter. From education comes the study of the effectiveness of various teaching approaches and from psychology comes the study of cognitive styles and individual differences. Each of these influences are discussed separately below.

Individual Differences. A number of writers have characterized the history of educational research as a futile search for the "ideal" instructional method (e.g., Cross, 1976; Keefe, 1979). Cross summarized this point as follows:

> "It now seems clear that we are not going to improve instruction by finding the method or methods that are good for all people. The research on teaching effectiveness has been inconclusive and disappointing because, I suspect, we were asking the wrong questions. When we ask whether discussion is better than lecture, whether television is as good as a live teacher, whether programmed instruction is an improvement over more traditional methods, we find that for that mythical statistical average student it seems to make little difference how we teach. But when we look at the data student by student, it is clear that some students improve, some remain unaffected, and a few actually regress under various teaching conditions. The very process of averaging the pluses, the minuses, and the nonchangers wipes out the message that different methods work for different students. Psychologists are now asking the more sophisticated interaction questions about learning styles - which methods work for which students?"

Much of the current interest in the implications of individual differences for learning seems to have arisen as a result of a conference held at the University of Pittsburg in 1965. The proceedings of that conference were edited and published by Gagne' in 1967. This conference was attended by both educators and psychologists who reviewed a number of areas or factors on which individuals differ and attempted to determine the implications

of those variables for instruction. One of the conclusions of that conference seems to have been that not a great deal was known about the effects of individual difference variables or the implications of individual differences for learning. Melton (1967), who summarized the findings of the conference, stated that in the previous 30 years a great deal of knowledge about basic learning processes had been acquired but that very little additional knowledge had been gained about the implication of individual differences for learning.

One of the more important papers at the Pittsburg conference was presented by Cronbach (1967). This paper seems to have been one of the pivotal articles in directing the attention of educational researchers to examining individual differences as an educationally important variable. In that article, Cronbach summarized previous efforts by educational researchers as an attempt to determine instructional procedures and organizational variables which were relevant to learning by students. He pointed out, however, that the implications of individual differences for learning had rarely been explored, at least not at anything but a superficial level.

One of the points made by Cronbach (1967) and repeated by others (e.g., Messick, 1976; Kogan, 1971) is that the American educational system has attempted for some time to "individualize" instruction at the administrative or organizational level. As an example, Cronbach cited the prevalent practice of eliminating students who did not meet some expected level of academic performance. For instance, those whose grade point average in high school was not high enough, were usually rejected for entrance into a college program in the past. Other responses to individual differences

included such things as different types of schools for individuals with different abilities or interests, the use of different "tracks" within a school, different tracks within a class, and, more recently, the use of a number of "personalized" instructional formats which allow for differences in learning rate or time. The latter systems often focus upon having students meet some specified level of knowledge irrespective of the amount of time the student needs rather than the more traditional approach of giving students a set amount of time and letting them acquire whatever amount of information they could within that time.

Aptitude by Treatment Interactions (ATI). Cronbach's (1967) article on the implications of individual differences for education was one of the primary catalysts for an area of research concerned with "Aptitude by Treatment Interactions" (ATI - sometimes called "trait-treatment interactions"). Keefe (1979) characterized the ATI approach as a systematic attempt to relate individual differences in aptitude to instructional method. The ATI hypothesis, Keefe continued, is that aptitudes in a general sense interact with instructional treatment or method to affect student learning.

As conceived by Cronbach and his associates, particularly Snow (Cronbach & Snow, 1977; Snow, 1980), the terms aptitude and treatment are fairly broadly defined. Snow (1980) stated that the term aptitude should not be restricted to general intelligence or general scholastic ability but can apply to such factors as prior achievement, special abilities, personality characteristics, and stylistic characteristics. The treatments in the ATI hypothesis can refer to a variety of things such as the type of instruction (e.g., discussion versus lecture), instructional media (e.g., computer

assisted instruction vs. slide tapes vs. films), and such things as variations in classroom characteristics or even differences in departmental or institutional environments.

In their voluminous review of the literature, Cronbach and Snow (1977) stated that the strongest evidence to date for significant ATIs involves measures of general ability. They included under the heading of general abilities such things as measures of intelligence, scholastic aptitude, nonverbal reasoning, and such things as reading tests, general aptitude tests, and previous grade-point average. The primary conclusion of their review was that individuals with high ability appear to learn best in an instructional environment where they are free to impose their own structure on the educational tasks. Individuals with low ability, on the other hand, do best when the instructor imposes the structure on the learning task. These authors concluded their summary by stating that "no Aptitude by Treatment Interactions are so well confirmed that they can be used directly as guides to instruction."

Cognitive Styles. Cronbach's (1967) paper also generated considerable work by a number of other researchers and educators who began to devote increased attention to the topic of individual differences and learning particularly with respect to psychological individual difference measures. Lesser (1971) strongly argued that a great deal of research dealing with individual differences could have importance for education. He contended that although educators had long studied individual differences in students, they failed to analyze the implications of these differences with reference to providing different types of instruction for individuals with those dif-

ferent needs. Lesser and also Glaser (1967) both pointed out that for almost a century psychologists had been attempting to eliminate or ignore individual difference variables as they studied learning. The focus of the learning research had been on identifying the underlying learning processes to the exclusion of studying how individual difference variables interacted with the learning processes. Thus, the literature from psychology had a great deal to say about both learning and individual differences but almost nothing to say about how the two interact.

Lesser (1971) and his fellow authors (e.g., Kogan, 1971) cited a number of individual difference variables with possible educational relevance. Among those were a number of cognitive style measures. The term cognitive styles has been used to describe over 20 individual difference variables which have been studied by psychologists. Goldstein and Blackman (1978), who reviewed five of the more well documented and heavily researched cognitive style measures, described them as hypothetical constructs used to explain behavior across a variety of situations. They further stated that cognitive styles refer to the characteristic ways in which individuals conceptually organize the environment. Kogan (1971) defined cognitive styles as "individual variation in modes of perceiving, remembering, and thinking, or as distinct ways of apprehending, storing, transforming and utilizing information." Messick (1976) defined cognitive styles as "consistent individual differences in ..... ways of organizing and processing information." Coop and Sigel (1971) stated that cognitive style "means consistency in individual modes of functioning in a variety of behavioral situations."

Messick (1976) who differentiated cognitive styles from abilities, stated that abilities deal with the content of cognition (the question of 'what') whereas style refers to the manner in which behavior occurs (the question of 'how'). He further stated that abilities tend to be unipolar whereas all cognitive style measures are bipolar dimensions. A unipolar dimension consists of a single attribute (e.g., intelligence), whereas a bipolar dimension has two opposing attributes (e.g., impulsive-reflective). A third difference consists of the value bestowed upon each concept. For ability, more is "better," whereas cognitive styles have been argued to be "value differentiated" in Messick's terminology. That is, each end of the bipolar cognitive style dimension is assumed to have positive value. A final difference noted by Messick was that cognitive styles are conceived of as broad characteristics which pervade a wide variety of behaviors and situations. Abilities, on the other hand, are conceived of as rather specific content areas.

Learning Styles. Keefe (1979) reviewed the learning style literature and stated that although learning styles and cognitive styles have sometimes been used synonymously, the former term is broader and includes affective and physiological factors as well. Other writers have also argued that the concepts are similar but not identical. Cross (1976) contended that cognitive styles were developed primarily to be used in research on cognitive differences and only quite recently has anyone considered the educational implications of such constructs. Learning styles, on the other hand, were developed primarily to assist educational practitioners. Semple (1982) listed a number of differences between the concepts. One such difference is that cognitive styles all deal with a single bipolar dimension, whereas most

learning style instruments deal with more than one factor and often these factors are of a "yes/no" variety. Kirby (1979) stressed that most of the learning style instruments were very practical in nature and include such things as the time of day at which one works most efficiently, lighting and heating conditions and the physical environment which lead to the greatest efficiency for an individual. She contended that cognitive style factors tend to be much more theoretically oriented.

The concept of learning styles seems to fit into the category of ATI research. The ATI research includes ability measures, as well as, style measures. Most of the factors included in the various learning style models fit into the somewhat loose definition of aptitudes provided by Snow (1980). There does seem to be a subtle difference in emphasis between the ATI research and the research done on learning styles, however. The overall goal of the ATI research seems to be the determination of whether ATIs actually exist and which variables are most relevant educationally. The overall goal of the learning style research seems to be more narrowly focused in that most of the studies which have been conducted thus far were designed to validate the particular instrument being tested.

Learning Disabilities. In recent years there has been considerable attention directed to the concept of learning disabilities. Some discussion of the relationship of learning styles to learning disabilities seems needed in order to clarify the differences between these terms. The concept of learning disabilities has been defined as follows:

"Specific learning disabilities are disorders of one or more of the cognitive processes involved in understanding, perceiving, and/or using language or concepts (spoken or written). The disorder may manifest itself in problems related to listening, thinking, speaking, reading, writing, spelling, or doing mathematical calculations. Specific Learning Disabilities do not include individuals who have problems which are primarily a result of visual, hearing, or motor handicaps; or mental retardation; or environmental, cultural or economic disadvantage (Pennsylvania Bureau of Vocational Rehabilitation, n.d.)."

As can clearly be seen in the above definition, a learning disability is perceived as a handicapping condition. Estimates vary, but something less than 10% of the population is believed to have a learning disability. A learning style, on the other hand, is not considered a handicap and is not limited to a small part of the population. All individuals are thought to have a particular learning style. Also, one learning style is not seen to be any better or worse than another, whereas, clearly it is better not to have a learning disability than to have one. There seems to be little overlap between the two concepts and in the way they are addressed.

PROBLEMS AND ISSUES IN THE APPLICATION OF LEARNING STYLES

A number of issues have been discussed in the literature relating to learning styles. In addition, a number of issues have been raised in the literature on cognitive styles and ATIs which are also relevant to learning styles. For instance, there has been considerable discussion in the literature of "matching strategies," the stability of learning styles, the ability to identify one's own learning style, teaching/learning style congruence, and the feasibility of implementing instruction based upon a large number of learning styles.

Matching strategies. This term refers to the practice of providing a specific instructional environment to a student based upon his/her learning style (or other attribute). Messick (1976) delineated a number of possible matching strategies. The most frequently cited matching strategy involves teaching the student in accordance with the student's learning style. For instance, when a kindergarten student has a "visual" learning style, the matching strategy would probably involve teaching that student to read with the site-word method which is a visually oriented technique. This type of matching strategy appears to be adhered to by most learning style theorists and instrument developers. A number of people (e.g., Davidman, 1981) have strenuously objected to this matching approach, however. They argue that such an approach may provide short term benefits but that it could stunt a student's intellectual development in the long run. They contend that presenting students with instructional mismatches could force them to learn to effectively use nonpreferred instructional modes. Such a position views learning styles as being similar to skills which can be improved upon through practice.

Stability of learning styles. A second issue, which has important implications for matching strategies, involves the stability of the various learning styles. Gregoric (1979) argued that most learning styles are inherited rather than learned. He concluded that, although students could adapt somewhat to nonpreferred instructional conditions, such adaptation would be minimal. Other researchers differ in their views of the stability of their learning style factors. Hunt (1977) actually expects change on his "conceptual level" construct. He expects a developmental growth towards higher conceptual levels which can be directly influenced by exposure to

various instructional formats. Most learning style theorists appear to believe that the factors in their instruments are relatively stable. Dunn, et al., (1981) stated that some of the factors in their instrument tend to change over time, whereas others remain stable. They refer to the elements which remain stable as factors and the nonstable elements as preferences. They assume that the latter can be modified through various motivational procedures.

Identifying one's own learning style. Davidman (1981) raised the issue of whether students, particularly young students, can accurately identify their own learning style. If they cannot identify their own learning style, then the validity of these instruments is questionable. In response to Davidman, Dunn (1980) cited four studies which have found evidence for ATIs in which a preference measure was used to identify individual learning styles. Although the data Dunn cited could be used to support the argument that on at least some learning styles factors individuals are capable of identifying their own style, it is not clear that this is true for all learning style factors.

Teaching/Learning Style Congruence. A number of people have mentioned the concept of teaching styles (e.g., Dunn, 1981; Cross, 1976). Most writers appear to believe that one's teaching and learning styles are closely related. Cafferty (1977) conducted a study in which she examined the grade point averages of high school students who were matched or mismatched to varying degrees with their teacher's learning styles (and presumably their teaching styles). Cafferty found that the greater the degree of match between teacher and student learning style, the higher the student's grade

point average. Some authors, such as Cafferty and also Dunn (1981), interpret this as evidence that students should be matched with teachers whose style corresponds to their own. How this could be accomplished is difficult to understand, however. Such an approach could conceivably require school systems to have several teachers in each school at each grade level so as to be able to match students and teachers. Our educational system simply doesn't have the resources to accomplish such a task. Ellis (1979) suggested that an alternative would be to assist teachers in developing a variety of teaching approaches which could meet the diverse learning style needs of their students.

Lack of technology for matching all possible styles. Finally, one of the more interesting criticisms which can be applied to the learning style approach was raised by Chickering (1981) and relates to a practical problem. He noted that we do not have the educational technology or know-how to meet the needs of a seemingly infinite number of learning styles. One instrument developed by Hill (1971) has over 2000 possible learning style combinations. If all of the other learning style instruments were considered there would be several thousand more possible learning style combinations. It seems evident that such a variety of learning styles would be too complex for an educational system to effectively deal with. This was Chickering's conclusion when he argued that we cannot deal with such complexity at the present time.

OVERVIEW OF SELECTED LEARNING STYLE INSTRUMENTS

There have been a number of learning style instruments developed over the past decade or so, reflecting a variety of models. Almost all of those

instruments are self reports in which the respondent states that an item is true or false or selects from a number of alternatives the item which most closely represents the respondent's preferences. Hunt's (1977) Conceptual Level model is an exception in that an individual's performance on a written assignment is evaluated by the instructor. Most of the instruments are paper and pencil tests although some can be orally administered. Several of the instruments are computer scored whereas others are hand scored. The underlying assumption of all of these instruments (models) appears to be a belief in the Aptitude by Treatment Interaction hypothesis. That is, that instructional effectiveness can be maximized by identifying relevant characteristics of individual students and modifying instructional practice to meet the needs of those students. The instruments differ largely in what the developers assume are the important characteristics (aptitudes in Cronbach and Snow's terminology; 1977).

Table 1 presents a list of the learning style elements contained in each of the instruments which were reviewed. The reader can determine the contents of the elements in Table 1 by referring to the appropriate descriptions listed in Table 2. The latter table classifies the elements in the instruments into five categories: cognitive factors, social factors, motivational/emotional factors, physical/environmental factors, and instructional factors, which has four subcategories. A brief description of each element is also contained in Table 2, along with the name of the instrument in which it is contained and the author(s) name. The tables are cross referenced by element number. For instance, to find a description of the first element ("self-oriented (15)") in the first instrument in Table 1 (the Learning Style Inventory by Dunn, et al.), use the element number listed in

TABLE 1

Comparison of the Dimensions and Elements of the Various Learning Style Instruments

Instrument Name	Factors: Cognitive	Social	Motivational	Physical	Instructional
Learning Style Inventory and the Productivity Environmental Preference Survey by Dunn, et al.		Self-oriented(15)* Peer-oriented(16) Learning with Adults(17) Learning with Authority Figure(18)	Motivated(32) Persistence(33) Responsibility(34)	Mobility(42) Time(43) Intake(44) Sound(45) Temperature(46) Design(47)	Need for Structure(54) Modality: Verbal(58) Written(59) Hands-on(60)
Learning Styles Inventory by Renzulli & Smith (1978)					Projects(77) Drill & Recitation(78) Peer Teaching(79) Discussion(80) Teaching Games(81) Independent Study(82) Programmed Instruction(83) Lecture(84) Simulation(85)
Your Style of Learning and Thinking by Torrance, et al. (1978)	Left Brain Dominant(1) Right Brain Dominant(2)				
Learning Styles Inventory by Canfield & Lafferty (1980)		Peer(19) Instructor(20) Competition(21) Authority(22)	Goal Setting(35) Expectation(36)		Numeric(48) Qualitative(49) Inanimate(50) People(51) Organization(52) Detail(53) Listening(61) Reading(62) Iconics(63) Direct Experience(64)
C.I.T.E. Learning Style Inventory by Babich, et al. (1976)		Individual Learner(23) Group Learner(24)			Visual(65) Auditory(66) Kinesthetic/ Tactile(67) Oral Expression sion(86) Written Expression(87)
Learning Interaction Inventory by Jacobs & Fuhrmann (1980)		Collaborative(25)			Dependence(55) Independence(56)
Grasha-Reichmann Learning Style Inventory (1975)		Competitive(26) Collaborative(27)	Independent(37) Dependent(38)		Participant Avoidant(88)
The Learning Style Inventory by Hanson & Silver (1980)	Perceiving (sensing and intuiting)(3) Making Judgements (thinking and feeling)(4)				
Learning Style Inventory by Kolb (1976)	Concrete Experience(11) Reflective Observation(12) Abstract Conceptualizations(13) Active Experimentation(14)				

*Each Element is cross-referenced by number to an element description in Table 2.

TABLE 1 Continued

Instrument Name	Factors: Cognitive	Social	Motivational	Physical	Instructional
Cognitive Style Mapping by Hill (1971)	Magnitude(5) Differences(6) Relationship(7) Appraisal(8) Deductive(9) Qualitative Code Esthetic(10)	Associates(28) Family(29) Individuality(30) Social Awareness Factors(31): a. kinesics b. proxemics c. transactional d. empathetic e. histrionics	Qualitative Code Ethic(39) Qualitative Code Synnoetic(40) Qualitative Code Kinesthetics(41)		Theoretical Auditory Linguistic(68) Theoretical Auditory Quantitative(69) Theoretical Visual Linguistic(70) Theoretical Visual Quantitative(71) Qualitative Auditory(72) Qualitative Olfactory(73) Qualitative Savory(74) Qualitative Tactile(75) Qualitative Visual(76)
Assessing Conceptual Level (with the paragraph completion method) by Hunt (1977)					Conceptual Level(57): A B C

TABLE 2

Description of the Elements Included in Various Learning Style Assessment Instruments

Type of Element	Element Name	Description of the Element	Instrument & Developer(s)
Cognitive:	1-Left Brain Dominant	-characterized by logical, analytical thinking	Your Style of Learning and Thinking by Torrance, et al (1978)
	2-Right Brain Dominant	-characterized by intuitive, creative thinking	
	3-Perceiving (sensing and intuiting)	-a bipolar dimension describing an individual's preferred manner of gathering information. Sensing refers to being more analytic and intuiting refers to being less analytic in terms of analyzing information.	The Learning Style Inventory by Hanson & Silver (1980)
	4-Making Judgements (thinking and feeling)	-a bipolar dimension describing an individual's preferred decision making style. A "thinker" makes decisions impersonally and logically. A "feeler" makes decisions less systematically	
	5-Magnitude	-the tendency to put things into categories, use rules and definitions, and classify things to make a decision.	Cognitive Style Mapping by Hill (1971)
	6-Differences	-tendency to make contrasts when making decisions.	
	7-Relationship	-tendency to note similarities when making decisions.	
	8-Appraisal	-use of Magnitude, Difference, and Appraisal when making decisions	
	9-Deductive	-use of logical proofs when making decisions.	
	10-Qualitative Code Esthetic	-capacity to enjoy the beauty of an object.	
	11-Concrete Experience	-able to involve self fully, openly, and without bias in new experiences	Learning Style Inventory by Kolb (1976)
	12-Reflective Observation	-able to observe and reflect on new experiences from many perspectives	
	13-Abstract Conceptualizations	-able to create concepts that integrate their observations into logically sound theories	
	14-Active Experimentation	-able to use theories to make decisions and solve problems	
Social	15-Self-oriented Learner	-preference for studying and learning alone	Learning Style Inventory by Dunn, et al.(1979)
	16-Peer-Oriented Learner	-preference for working with fellow students when learning	
	17-Learning with Adult	-preference for learning with the help of adults	
	18-Learning with Authority Figure	-preference for learning in the presence of an authority figure	
	19-Peer	-preference for working in student teams when learning	Learning Styles Inventory by Canfield & Lafferty (1980)
	20-Instructor	-preference for working with teachers in a warm, friendly milieu	
	21-Competition	-desiring competition with others in learning situations	
	22-Authority	-desiring classroom discipline and order	
	23-Individual Learner	-learns more when working alone	C.I.T.E. Learning Style Inventory by Babich, et al.(1976)
	24 Group Learner	-learns best with at least one other person present	
	25-Collaborative	-prefers working and interacting with peers or a collaborative teacher when learning	Learning Interaction Inventory by Jacobs & Furhmann (1980)
	26-Competitive	-prefers competing with other students for grades and teacher attention	Grasha-Reichmann Learning Style Inventory (1975)
	27-Collaborative	-prefers working with other students in a learning situation	
	28-Associates	-seeks and interprets meaning through interaction with associates	Cognitive Style Mapping by Hill (1971)
	29-Family	-seeks and interprets meaning through interaction with authority figures	
	30-Individuality	-seeks and interprets meaning independently	
	31-Social Awareness Factors:		
	a. kinesics	-capacity to understand and use nonverbal communication	
	b. proxemics	-ability to judge appropriate physical social distance and act accordingly	
	c. transactional	-ability to maintain positive channels of communication with others	
	d. empathetic	-capacity to derive meaning through sensitivity to the ideas and feelings of others	
	e. histrionics	-capacity to perceive expected behavior and act accordingly	

TABLE 2 Continued

Type of Element	Element Name	Description of the Element	Instrument & Developer(s)
Motivational	32-Motivated	-degree of desire to accomplish and succeed in learning tasks	Learning Styles Inventory by Dunn, et al. (1979)
	33-Persistence	-ability to stick to a task until completed	
	34-Responsibility	-ability to follow through on a task and complete it without frequent supervision	
	35-Goal Setting	-preference for setting one's own objectives and making one's own decisions when learning	Learning Style Inventory by Canfield & Lafferty
	36-Expectation:		
	"A"	-anticipating that one will do superior in a learning situation	
	"B"	-anticipation of above average performance in a learning situation	
	"C"	-anticipating doing average or satisfactory at a learning task	
	"D"	-anticipating below average or poor performance at a learning task	
	37-Independent	-preference for learning alone and controlling learning activities	Grasha-Reichmann Learning Styles Inventory (1975)
	38-Dependent	-needs external structure imposed on learning activities	
	39-Qualitative Code Ethic	-commitment to the work ethic	Cognitive Style Mapping by Hill (1971)
	40-Qualitative Code Synnoetic	-ability to set realistic goals for oneself	
	41-Qualitative Code Kinesthetics	-willing to practice a motor skill to achieve a high skill level	
Physical	42-Mobility	-preference for being able to move around when learning/working	Learning Style Inventory and P.E.P.S. by Dunn, et al.(1979)
	43-Time	-preference for working/learning at a certain time of day	
	44-Intake	-preference for being able to eat or drink while learning	
	45-Sound	-preference for specific levels of sound when learning/working	
	46-Temperature	-preference for a specific temperature when working/learning	
	47-Design	-preference for formal or informal surroundings when learning	
Instructional-Content	48-Numeric	-enjoys working with numbers and logic	Learning Styles Inventory by Canfield& Lafferty (1980)
	49-Qualitative	-enjoys working with words or language	
	50-Inanimate	-enjoys working with things; building, repairing, designing, etc	
	51-People	-enjoys working with people; interviewing, counselling, selling	
Instructional-Structure	52-Organization	-prefers course work logically and clearly organized	Learning Style Inventory by Canfield & Lafferty (1980)
	53-Detail	-prefers specific information on assignments, requirements, rules	
	54-Need for Structure	-prefers learning (working) with specific instructions and rules	Learning Style Inventory and P.E.P.S. by Dunn, et al. (1979, 1980)
	55-Dependence	-needs to learn with structure imposed by teacher	Learning Interaction Inventory by Jacobs & Furhmann (1980)
	56-Independence	-learns best when allowed to impose own structure and organization on task	
	57-Conceptual Level:		Assessing Conceptual Level (with the paragraph completion method) by Hunt (1977)
	A	-needs a great deal of structure imposed upon a learning task	
	B	-needs a moderate level of structure to do well	
	C	-needs relatively little structure to learn well	
Instructional-Modality	58-Verbal	-learns best through auditory sense	Learning Style Inventory and P.E.P.S. by Dunn, et al. (1979, 1980)
	59-Written	-learns best through visual sense	
	60-Hands on	-learns best through tactile and kinesthetic senses	
	61-Listening	-prefers to learn by hearing information; lectures, tapes, etc.	Learning Styles Inventory by Canfield & Lafferty (1980)
	62-Reading	-prefers to learn by examining written material	
	63-Iconics	-prefers to learn by viewing illustrations, graphs, movies,slides	
	64-Direct experience	-prefers to learn by handling and manipulating things	

TABLE 2 Continued

Type of Element	Element Name	Description of the Element	Instrument & Developer(s)
Instructional-Modality	65-Visual	-learns best from visually presented material	C.I.T.E. Learning Style Inventory by Babich, et al. (1976)
	66-Auditory	-learns best from hearing spoken works	
	67-Kinesthetic/Tactile	-learns best by touching and manipulating things	
	68-Theoretical Auditory Linguistic	-learns best by talking or listening to words	Cognitive Style Mapping by Hill (1971)
	69-Theoretical Auditory Quantitative	-learns by listening to a discussion of mathematical concepts	
	70-Theoretical Visual Linguistic	-learns by writing or reading written composition	
	71-Theoretical Visual Quantitative	-learns from written numerals or mathematical symbols	
	72-Qualitative Auditory	-learns from sounds other than words	
	73-Qualitative Olfactory	-learns from odors, smells, aromas	
	74-Qualitative Savory	-learns from taste	
	75-Qualitative Tactile	-learns from touching and feeling	
	76-Qualitative Visual	-learns from seeing things other than written material	
Instructional-Formats	77-Projects	-preference for learning by working on class projects alone or with others	Learning Styles Inventory by Renzulli & Smith (1978)
	78-Drill & Recitation	-preference for learning with clear assignments and requirements for displaying knowledge gained	
	79-Peer Teaching	-preference for learning from classmates	
	80-Discussion	-preference for learning by talking about material	
	81-Teaching Games	-enjoys learning material through instructional games	
	82-Independent Study	-enjoys working alone to explore new content areas and to prepare material for presentatin to class	
	83-Programmed Instruction	-enjoys working in an externally structured situation and by responding to questions assigned by the teacher	
	84-Lecture	-enjoys hearing the teacher explain things	
	85-Simulation	-enjoys participating in carefully structured activities which attempt to teach by modelling real world situations	
	86-Oral Expression	-preference for verbally expressing what one knows about a topic	C.I.T.E. Learning Style Inventory by Babich, et al (1976)
	87-Written Expression	-preference for expressing one's knowledge in writing	
	88-Participant Avoidant	-preference for discussion and open interchange of ideas -characterized by a lack of interest in classroom learning	Grasha-Reichmann Learning Inventory (1975)

parentheses to search for its description in Table 2. As one can see, element number 15 is the first one listed under the 'Social' elements in Table 2. A detailed description of each of the instruments included in the two tables is provided in Appendix A, including information about the reliability and validity of each of them. Appendix B presents information on where the instruments can be obtained and their costs.

Although there are considerable differences among the various learning style models, there is some overlap in content. For example, the Grasha-Reichmann (1975) participant-avoidant dimension, which is a measure of preferences for the traditional classroom approach seems to overlap with the Renzulli and Smith (1978) measure of preference for lectures. Also, the Dunn, et al., Canfield and Lafferty (1976), C.I.T.E. (1976), and Jacobs and Fuhrmann (1980) instruments all assess, to some extent, the students preference to work alone or in collaboration with others. Further commonalities can be seen among the cognitive factors. The Dunn, et al., and Torrance and Reynolds (1978) instruments both assess cerebral dominance to some extent. A number of instruments also assess the instructional-modality preferences of learners (e.g., the C.I.T.E., 1976; Canfield & Lafferty, 1976, Dunn, et al., 1979). There also appears to be considerable overlap between the Hanson-Silver (1980) instrument and the Kolb (1976) instrument which both include "thinking" and "feeling" factors in their instruments. In addition, there is some overlap among the motivational factors in the various instruments. For instance the Dunn, et al. (1979) and the Canfield and Lafferty (1976) instruments both appear to assess the degree of autonomy (responsibility) a student can accept. The Grasha-Reichmann and Canfield and Lafferty instruments both assess the degree of competitiveness of students.

LEARNING STYLE ASSESSMENT AND VOCATIONAL REHABILITATION

As has been already suggested, while much interest exists with regard to the issues of "learning styles," a significant amount of uncertainty and controversy still exists within the educational community with regard to the practical implications of this construct in relation to the average student's needs. The issue becomes even murkier when attempting to apply the construct of learning styles to disabled students and adults. This is especially true because there has been increasing discontentment with most of the traditional psychometric tests that are used with handicapped students and vocational rehabilitation clients. Indeed, Schalock and Karan (1979) wrote:

> There is little evidence suggesting that changes in traditional psychological and vocational assessment practices have occurred. At present, perhaps because other alternatives do not exist, vocational (re)habilitation agencies are using assessment procedures originally developed for less handicapped individuals and are applying them invalidly to the more severely handicapped.
>
> (p. 34)

Within vocational rehabilitation, issues such as learning assessment and learning style preferences affect our understanding and predictions of handicapped individuals employment potential. This issue, particularly when presented within the context of vocational evaluation services, has become increasingly important (Rusalem and Rusalem, 1976; Feuerstein, et. al., 1979; McCray, 1979; Schalock and Karan, 1979) suggesting that it may call into question the entire vocational assessment process as it is now practiced. The crux of this problem is the extent to which standardized assessment instruments and clients' learning styles interact to influence perform-

ance and estimates of client performance capabilities. McCray (1979) states that:

> ...inadequate instructional procedures are one of the major causes of misinterpreting client performance. If, during the learning phase, an evaluator communicates instructions to a client and the client does not understand the directions, he will be unable to perform the tasks. All too easily this can lead to the erroneous conclusion that the client lacks ability in the tested area rather than that the client did not thoroughly understand what to do simply because the instructional format required him to utilize skills which were limited by his learning disability. By including learning assessment as part of the evaluation process, the evaluator is forced to consider whether or not the instructional procedures provided in the learning phase were appropriate for the individual. This activity helps assure that a valid picture of client performance capability emerges. (p. 4)

Performance can be influenced by the degree to which a client's individual style corresponds with the instructional strategies used. Trautman (1979) and Cafferty (1980) both found that students perform best when their individual learning styles are compatible with the type of instructional material used and the teaching style of the instructor. Indeed, one of the learning style instruments described in the next section addresses this very issue. The Grasha-Reichmann Student Learning Styles Questionnaire is a research tool designed to study, in part, the effects of matching student learning styles with a compatible teaching style and to learn how different teaching styles or formats affect individuals with different learning styles. A study conducted by Andrews (1981) further suggested that students benefit from being in a learning environment which is compatible with their learning style. Yet the research evidence is far from conclusive and little work has been done within the context of working with handicapped learners.

If, however, matching instructional strategies to student learning styles does, in fact, facilitate student performance, then it seems apparent that one of the fundamental goals of vocational evaluation ought to be to identify client learning style preferences so that the resulting recommendations for job training, work adjustment training, and other services would thoroughly delineate the type of instructional strategy that teachers, whether academic or vocational, could use to facilitate client performance. Further, it seems that where significant differences exist between the instructional strategies used for test administration and client learning styles are concerned, every attempt should be made to modify the standardized testing procedure to accommodate client capabilities and ensure more accurate measures of performance capability. Feuerstein et. al., (1979) supported this concept in stating:

> ...the adherence to a static model of assessment, characteristic of conventional psychometric approaches, can only result in a tautological process in which a manifest level of functioning, already known to be low, is once again demonstrated by the poor results obtained by the examinee. We therefore suggest that to break this vicious circle, we must evolve, implement, and evaluate a new approach to the assessment of retarded performance. The measurement and remeasurement of existing capacities should be abandoned in favor of first inducing and then assessing modified performance right in the test situation itself. In such assessment of modifiability we must attack the cognitive functions found to be directly responsible for the usually demonstrated deficiencies. Also, we must continually take into account that these deficiencies are experienced by the examinee at the input and output phases of the mental act and/or are attributable to its motivational and emotional components and do not necessarily reflect a deficient elaborational capacity of the individual. (p. 89)

Further support for the practice of modifying standardized test procedures in vocational evaluation programs was indicated by the Commission

on Accreditation of Rehabilitation Facilities (CARF) (1983) which has adopted the following vocational evaluation standard:

> 2. Appropriate adaptive assessment tools and methods should be used wherever possible with individuals having sensory, physical, communicative or other fundamental impediments (e.g., visual, hearing, speech, orthopedic, language, cultural, or learning disabilities) which might invalidate otherwise standardized procedures.(p.50)

BENEFITS OF LEARNING STYLE ASSESSMENT

It seems, then, that important benefits may be derived from diagnosing the learning preferences or styles of individual handicapped clients. McCray (1979) indicated:

> Assessing how a client learns is one of the most important functions of vocational evaluation. There are two basic reasons for this. First, the ways in which an individual can learn information certainly have a strong impact on their vocational development. All jobs, no matter how simple, require some degree of learning, yet disabilities such as blindness, deafness, mental retardation, and aphasia obviously limit some of the modes by which a person may learn. Yet, in most cases, once the learning problem has been identified, modifications of the instructional or training procedures can be made, e.g., audiotaping of written materials or sign language. Such adaptations allow handicapped persons to learn behaviors and skills which could not otherwise be possible. Thus, their personal, social, and vocational opportunities are greatly expanded.
>
> Secondly, with regard to vocational evaluation and particularly work and job sample testing, an individual's ability to learn to follow a standardized set of instructions has a significant influence over performance capability. For if a client is unable to understand the instructions provided in a work sample, it is unlikely that he will acquire the requisite behaviors necessary to perform the assigned task. In many such cases the resulting poor performance is erroneously interpreted as

indicating a lack of task related ability rather than evidence of specific or general learning disturbances. In such cases, the learning problems often remain completely undetected, and thus little or no effort is made to modify the instructional format so as to facilitate client learning. (p. i)

There are a number of areas in the rehabilitation process where the information gathered as a result of learning style diagnosis might be helpful:

1. In vocational evaluation, the failure to recognize an individual's preferred learning style may lead to underestimating the ability level of that individual.

2. Also in vocational evaluation, the purpose should not simply be to document poor performance, but also to determine what is causing it and what can be done about it. The need exists (McCray, 1979; Rusalem & Rusalem, 1976) to determine whether performance deficits actually reflect a lack of ability or whether these "deficits" result from (1) the way in which task requirements are presented and/or (2) some aspect of the way in which performance is tested.

3. Learning assessment, if valid and reliable, would alter the amount of time spent in the rehabilitation process especially during work adjustment and/or skill training.

4. Learning assessment focuses on the individual's needs and abilities rather than on groups. Such an approach would enhance a client centered rehabilitation process rather than a bureaucratic one.

In addition, a number of other potential benefits are evident. Recognizing the fact that individualized training and teaching activities play an important role in almost all work adjustment programs, information on a client's learning style preferences would be most useful in further individualizing his work adjustment training/learning programs. The same data can

also be useful to employers who have no experience working with disabled employees. It can help provide them with the background information and structure they need to help ensure that the training and orientation delivered to their new disabled employees will be as readily accepted and learned as possible. In a sense, trainer and trainee will have the information they need to facilitate communication and help ensure that they are "speaking the same language" during the initial job training experience.

Perhaps of utmost importance, when learning style diagnosis is incorporated into the initial stages of the vocational evaluation process, it can help alleviate the threat or uncertainty of administering an entire series of tests to a handicapped individual via an inappropriate instructional format. For example, the Learning Styles Inventory: A Measure of Student Preference for Instructional Techniques, specifically assesses students' preferences for nine instructional practices, one of which is programmed instruction. For vocational evaluation programs that rely heavily on programmed systems like Singer, it would probably be worthwhile to assess clients' preferences with regard to this instructional/learning format. Should they have a substantial dislike for programmed instruction activities, the evaluator would then have a sound basis for modifying, at least in part, the evaluation process for this particular client. This in turn, might help reduce the likelihood of misinterpreting client performance as a result of using incompatible instructional techniques during the test administration process.

Finally, further support for the fundamental concept of incorporating learning diagnosis within the overall vocational evaluation process was

indicated by CARF (1983) which adopted the following vocational evaluation standard:

> 1. The range and scope of the evaluation services should be sufficiently comprehensive to assess or obtain information concerning at least the following:
>
> a...
> o. Assessment of the most effective mode of understanding and responding to various types of instructions.
> (p. 50)

Recognizing the potential benefits of diagnosing individual client learning style preference, there is a natural tendency to seek out assessment instruments which will provide a valid and reliable measure of individual learning styles. Many different psychometric instruments do exist which purport to measure individual learning styles or "cognitive preference." The vast majority of existing instruments, however, appear to be most readily applicable to a secondary school setting where the emphasis is on academic concerns. There is a pronounced lack of vocational orientation with all of these instruments with perhaps the exception of the Productivity Environmental Preference Survey.

LIMITATIONS OF LEARNING STYLE ASSESSMENT INSTRUMENTS

Those instruments that are considered to have the most potential for use in rehabilitation settings are described and explored in greater detail later in this monograph. Suffice it to say, however, that there are at least five major problems with these and other learning style/cognitive preference measurement instruments reviewed as part of this project:

(1) None of the instruments is specifically designed

for use with the type of severely handicapped clients commonly served in rehabilitation facility-based vocational evaluation programs (i.e., mentally retarded, learning disabled, and other developmentally delayed individuals).

(2) As a result of (1) above, much of the information derived from the use of these instruments with these populations must be called into question.

(3) Few of the instruments have a clearly stated vocational relevance. The results of the testing are, by-in-large, relevant for educational programming.

(4) These instruments are primarily based on the traditional psychometric approach to human measurement. Despite the fact that most have relatively little technical data supporting their validity or reliability, most are, however, highly standardized. As a result, vocational evaluators using any of these instruments will find that they are once again faced with the original dilemma of using highly-standardized, traditional psychometric instruments with nontraditional types of evaluees. As a result, the fundamental questions of test appropriateness, separating learning from performance, task bias, instrument modification, etc., still persist.

(5) As indicated previously, all of the instruments reviewed in this project rely on the testee's ability to make accurate judgements about himself. The extent to which these judgements are accurate can be greatly influenced by the client's disability, particularly when working with mentally handicapped individuals. This fact, and the potential impact on the validity of the instruments used, must always be recognized by the test examiner.

Despite these limitations, these instruments are not entirely without merit in terms of their use in vocational evaluation. They can often provide useful data which can facilitate the evaluator/client counseling process because they provide a concrete basis upon which the evaluator and client can further explore the latter's learning preferences and limitations. For example, the Learning Style Inventory (LSI), could provide data

which would be useful to the client and evaluator in helping the client better adjust to sociological, psychological, emotional, physical, and environmental factors that will inevitably affect the learning environment whether on the job or in the classroom. Further, while a client might indicate that he has a pronounced preference for individualized learning vs. group training, the realities of an OJT might necessitate compromise on both his part and the employer's in terms of the available training program. In such an instance, the assessment instrument can be a useful tool for diagnosing this area of potential conflict, and effectively dealing with it through the counseling process before it becomes a significant problem.

Finally, some of the instruments described may also serve as useful tools for either corroborating or challenging observations the evaluator may have made about client instructional needs and learning preferences, based on less structured, "situational" tasks. They should not, however, be viewed as substitutes for the process of observing client behavior over extended periods of time and thereby making clinical judgements about learning/teaching needs. Indeed, as Hunter (1979) indicated with regard to learning style diagnosis in educational settings:

> Informal diagnosis is the heart and soul of diagnostic teaching. For each individual or situation, informal diagnosis yields bountiful information at the moment it is needed. The information may be less accurate then the results from formal diagnosis, but the information is reasonably reliable and immediately available... Informal diagnostic information may be obtained through group feedback or sensitive observation. (p. 45)

In any case, evaluators should recognize that measurement of how an individual learns, in terms of learning style preferences instead of IQ, is

not a concept which is entirely new to vocational evaluation. Nor is the idea of modifying standardized vocational evaluation procedures to accommodate client limitations new. As early as 1975, the Vocational Evaluation and Work Adjustment Association (Kulman et. al., 1975) established:

> ...if a client does not perform adequately following standardized industrial instructions, it is necessary to determine what types of instruction will facilitate his understanding of the task... The evaluation of the client's ability to learn, their retention, and most efficient means of acquiring initiative are integral parts of the total assessment process. (p. 45)

Two approaches which have been used in rehabilitation are quite closely related to the learning style approach. These are the "Learning Capacities" approach developed by Rusalem and Rusalem (1976) and "Try Another Way" developed by Marc Gold (1973). The Rusalem's approach was developed to help severely handicapped individuals who were not making adequate progress in learning a vocational skill or in performing on an actual job. This approach involves: 1) administering a battery of tests which assesses cognitive and perceptual skills, 2) observing individuals as they perform the work task, and 3) manipulating environmental or instructional variables until the individual learns to perform the task. In many respects, the latter two steps of this process are much like mini-experiments designed to determine the conditions under which the individual learns and performs best. The strength of such an approach is that assumptions about how someone learns best are actually tested in the assessment procedure. A drawback to this approach is that it is time consuming and, presumably, expensive. For that reason, its use has been limited to only those individuals who are not making progress towards their employment related rehabilitation goals.

The basic assumption of Gold's approach is that mentally retarded people are capable of learning, but they cannot learn as readily, nor necessarily in the same manner, as nonretarded people. They often require highly individualized instruction which is developed using quasi-experimental methods to determine what instructional method works best for that individual. The approaches of Gold and the Rusalem's are very similar with respect to the latter point.

CONCLUSIONS

The purposes of this manuscript were to review the literature related to learning style diagnosis and related concepts, to discuss the need for such instruments and how they might be used in rehabilitation, and to provide detailed descriptions of several currently available instruments. The review of the literature revealed that the concept of learning styles is relatively new, and apparently evolved from attempts to synthesize the research findings in the areas of both individual differences in cognitive styles and of the effectiveness of various instructional methods. Learning styles appear to be a subcategory of the Aptitude by Treatment Interaction hypothesis which assumes that students will learn most efficiently and effectively when they are taught with a method which is compatible with their individual aptitudes.

Although all of the instruments we reviewed appear to be compatible with the ATI hypothesis, there is great diversity in their content. There are over 80 different elements or factors contained in those 12 instruments.

The instruments apparently differ in what the developers assumed were the critical dimensions along which instruction should be varied.

In reviewing the available instruments, the authors attempted to take a neutral position as to the probable utility of each one. This was done so as not to discourage the use of instruments which might prove useful to practitioners, despite any misgivings we might have about their reliability and validity. We encourage the reader to be critical in evaluating and selecting any of these instruments, however.

We were particularly interested in providing information about the reliablity and validity of each of the instruments we reviewed. In some cases, the information we were able to provide is somewhat scant. This was because the manuals which accompanied the instrument did not contain much information relative to these issues. We found no instrument that we feel has adequate evidence of reliability and validity at this time. In fairness to the developers of the instruments, however, it should be noted that most of these instruments are relatively new and that it will take time to collect the data necessary to support their reliability and validity. Some of the authors explicitly refer to their instruments as being experimental in nature.

Presumably, the developers of these instruments will eventually obtain the data to support or refute the reliability and validity of each of them. In the meantime, we recommend that the "buyer beware." If you consider purchasing one of these instruments, review it critically. You may want to take the test yourself or give it to a few friends. If you decide to pur-

chase an instrument, buy a limited amount at first and critically test them. Do they provide you with useable information? Can the information that you obtain confirm your observations of a client's capabilities? Do you actually use the information gained from the instrument in designing or implementing programs for clients? These questions and others can guide you in determining whether to purchase or to continue to use any of these instruments.

REFERENCES

Andrews, J. (1981). Teaching format and student style: Their interactive effects on learning. Research in Higher Education, 14, 161-178.

Babitch, A. M. (1980), Burbine, P., Albright, L., & Randol, P. C.I.T.E. learning styles instrument. In N. Howard (Ed.), Puzzled about educating special needs students: A handbook on modifying curricula for handicapped students. Madison: Wisconsin Vocational Studies Center, University of Wisconsin-Madison.

Cafferty, E. (1980). An analysis of student performance based upon the degree of match between the educational cognitive style of the teacher and the educational cognitive style of the students. Unpublished doctoral dissertation, University of Nebraska.

Canfield, A. A., & Lafferty, J. C. (1976). Learning Styles Inventory. Detroit: Humanics Media.

Chickering, A. W. (1981). The modern American college. San Francisco: Jossey-Bass.

Claxton, C. S., & Ralston, Y. (1978). Learning Styles: Their impact on teaching and administration. AAHE-ERIC/Higher Education Research Report No. 10. Washington, D.C., American Association for Higher Education.

Commission on the Accreditation of Rehabilitation Facilities (CARF, 1983). Standards manual for facilities serving people with disabilities. Tucson, Arizona.

Coop, A. H., & Sigel, I. E. (1971). Cognitive Style: Implications for learning and instruction. Psychology in the Schools, 2, 152-161.

Cronbach, L. J. (1967). How can instruction be adapted to individual differences? In R. M. Gagne's (Ed.), Learning and individual differences. Columbus, OH: C. E. Merrill Publishing Co.

Cronbach, L. J., & Snow, R. E. (1977). Aptitude and instructional methods: A handbook for research on interactions. New York: Halstead Press.

Cross, K. P. (1976). Accent on learning. San Francisco: Jossey-Bass.

Davidman, L. (1981). Learning style: The myth, the panacea, the wisdom. Phi Delta Kappan, May, 641-646.

Della-Dora, D., & Blanchard, L. J. (Eds.; 1979). Moving toward self-directed learning: Highlights of relevant research and promising practice. Alexandria, VA: Association for Supervision and Curricular Development.

Dunn, R. (1981). Editorial. Learning Styles Network Newsletter, Autumn, 2.

Dunn, R., DeBello, T., Brennan, P., Krimsky, J., & Murrain, P. Learning Style Researchers Define Differences Differently. Educational Leadership, 38, 5, 372-375.

Dunn, R., Dunn, K., & Price, G. (1977). Learning Style Inventory Research Report. Lawrence, Kansas: Price Systems.

Dunn, R., Dunn, K., & Price, G. (1979). The learning style manual. Lawrence, Kansas: Price Systems.

Esser, T. (1975). Client rating instruments for use in vocational rehabilitation agencies. Menomonie, Wisconsin: University of Wisconsin-Stout, Stout Vocational Rehabilitation Institute, Materials Development Center.

Feuerstein, R. (1979). The dynamic assessment of retarded performers: The learning potential assessment device. Baltimore, Maryland: University Park Press.

Gagne', R. M. (1967). Learning and Individual Differences. Columbus, OH: C. E. Merrill Publishing Co.

Glaser, R. (1967). Some implications of previous work on learning and individual differences. In R. M. Gagne' (Ed.), Learning and individual differences. Columbus, OH: C. E. Merrill Publishing Co.

Gold, M. (1973). Vocational habilitation for the mentally retarded. In N. R. Ellis (Ed.), International review of research in mental retardation, Vol. 6. New York: Academic Press.

Goldstein, K. M., & Blackman, S. (1978). Cognitive style: Five approaches and relevant research. New York: John Wiley and Sons.

Gregoric, A. (1979). Learning/Teaching Styles: Their nature and effects. In James W. Keefe (Ed.) Student learning styles: Diagnosing and Prescribing Programs. Reston, VA: National Association of Secondary School Principals.

Hanson, H. F., & Silver, J. R. (1980). The TLC learning style inventory: A self diagnostic tool for adults to assess learning styles preferences. Moorestown, NJ: Hanson, Silver & Associates.

Hill, J. D. (1971). The educational sciences. Bloomfield Hills, MI: Oakland Community College Press.

Hunt, D. E. (1977). Assessing conceptual level by the paragraph completion method. Toronto: The Ontario Institute for Studies in Education.

Hunt, D. (1976). Teachers are psychologists, too: On the application of psychology to education. Canadian Psychological Review, 17, 210-218.

Hunter, M. (19?9). Diagnostic teaching. Elementary School Journal, 45.

Jacobs, R. T., & Fuhrman, B. S. (1980). Learning interaction styles: Development testing, uses of an inventory - Research Report. Richmond, VA: Ronne Jacobs Associates.

Keefe, J. (1979). Student learning styles: Diagnosing and prescribing programs. Reston, VA: National Association for Secondary School Principals.

Kirby, P. (1979). Cognitive style, learning style, and transfer skill acquisition. Columbus, OH: National Center for Research in Vocational Education.

Kogan, N. (1971). Educational implications of cognitive styles. In Psychology and Educational Practice by G. S. Lesser (Ed.). Glenview, IL: Scott, Foresman and Company.

Kolb, D. A. (1976). Learning styles inventory: Technical manual. Boston: McBer and Company.

Lesser, G. S., (1971). Psychology and educational practice: An uneasy alliance. In G. S. Lesser (Ed.), Psychology and educational practice. Glenview, IL: Scott, Foresman and Company.

McCarthy, B. F. (1981). The 4 Mat System: Teaching the learning styles with right/left mode techniques. Arlington Heights, IL: Mark Anderson and Associates.

McCray, P. (1979). Learning assessment in vocational evaluation. Menomonie, WI: Materials Development Center.

Melton, A. W. (1967). Individual differences and theoretical process variables: General comments on the conference. In R. M. Gagne' (Ed.), Learning and individual differences. Columbus, OH: C. E. Merrill Publishing Co., 1967.

Messick, S. (1976). Individuality in learning. San Francisco: Jossey-Bass.

Pennsylvania Bureau of Vocational Rehabilitation (no date). Guidelines for serving the learning disabled. Harrisburg, Pennsylvania.

Reichmann, S., & Grasha, A. (1974). A rational approach to developing and assessing the construct validity of a student learning style scale instrument. The Journal of Psychology, 87, 213-223.

Renzulli, J. A., & Smith, L. H. Learning styles inventory: A measure of student preference for instructional techniques. Mansfield Center, Connecticut: Creative Learning Press, Inc., 1978.

Rusalem, H., & Rusalem, H. (1976). The learning capacities approach. Unpublished manuscript.

Semple, E. E. (1982). Relationship of learning style modality preferences and sociometric choices. Unpublished doctoral dissertation. University of Akron.

Schalock, R., & Karan, O. (1979). Relevant assessment: The interaction between evaluation and training. In G. Bellamy, G. O'Connor, and O. Karan (Eds.), Vocational rehabilitation of severely handicapped persons. Baltimore, MD: University Park Press.

Snow, R. E. (1980). Aptitudes and instructional methods: Research on individual differences in learning-related processes. Stanford, CA: School of Education, Stanford University.

Trautman, P. (1979). An investigation of the relationship between selected instructional techniques and identified cognitive style. Unpublished doctoral dissertation, St. John's University.

Torrance, E. D., Reynolds, C. R., Ball, D. E., & Riegel, T. R. (1978). Revised norms-technical manual for your styles of learning and thinking. Athens, GA: Department of Educational Psychology, University of Georgia.

Vocational Evaluation and Work Adjustment Association (1975). Vocational evaluation project final report. Vocational Evaluation and Work Adjustment Bulletin, 8, Special Edition.

APPENDIX A

Summaries of 12 Individual

Learning Styles Instruments

SUMMARIES OF INDIVIDUAL LEARNING STYLE INSTRUMENTS

This section of the monograph presents an overview and comparison of the learning style instruments reviewed as part of this project. Each of these instruments was selected because of its direct relevance to the process of learning style assessment as described in the first section of this monograph. As a result, other instruments more directly concerned with assessing learning disabilities or cognitive styles have not been included.

One common characteristic the reader will notice about the instruments reviewed is that they vary greatly in the nature of the questions and the content area they cover. Some of them are concerned with very practical things, such as lighting conditions, whereas others are more theoretical. The underlying purpose of all these instruments seems quite similar, however. They were designed to help an individual student or a teacher identify ways of modifying the learning environment which would facilitate learning by that student. In any case, it is hoped that with the information provided in the following paragraphs vocational evaluation practitioners will be better able to select and evaluate those instruments that might help aid them in their efforts to assess their client's individual learning style preferences.

As stated above, the following discussion is limited to instruments which assess learning styles as defined by the authors of those instruments or by others. Cognitive style measures will be left out of the discussion despite the fact that some writers, such as Keefe (1979), consider them to be one component of learning styles. Those instruments will be not dis-

cussed here, however, because they have been extensively reviewed elsewhere (e.g., Messick, 1976; Lesser, 1971).

Some explanations about the information included in the comparisons of the instruments is in order. The administration time for each instrument was included but those times probably underestimate the amount of time that some handicapped individuals will need to complete them. A few of the instruments state that they can be verbally administered. It is suspected that others could also be given verbally, but that is only a guess.

Esser (1975), when writing about the use of client rating forms in rehabilitation, stated that one of the assumptions of such instruments is that the user is capable of making fairly accurate judgements about the people being rated. A similar assumption applies to the use of learning style assessment instruments. With all of the instruments that we reviewed, clients are called upon to make judgements about themselves. It is assumed by the developers of these instruments that these judgements are sound. As was suggested earlier in this monograph, to the extent that these judgements are inaccurate, the instruments are not valid. This issue is of serious concern when using these instruments and should be kept in mind when deciding to use one of these instruments or when actually using it.

Finally, there was one instrument which we reviewed that is not included in the descriptions that follow. The 4-Mat System by Bernice McCarthy of Excel, Inc, was not included because it is a combination of the instruments developed by Kolb and Torrance which are included. The inclusion of the McCarthy instrument would therefore be somewhat redundant.

Learning Style Inventory (LSI) by Dunn, Dunn, and Price (1979). This instrument was developed for use with students in grades 3 through 12. Its purpose is to identify the conditions under which a student is most likely to learn, achieve, create, or solve problems. The instrument is a 104 item self report administered in a written format, on tape, or orally. The questions are "true/false" and takes approximately 25-35 minutes to complete.

The test has five major content areas, each with a number of separate elements. They are:

(a) Environmental factors which include such things as sound, lighting, temperature, and design conditions of the learning environment.

(b) Emotional factors such as levels of motivation, persistence, and responsibility, and the need for structure.

(c) Sociological factors which include such things as the need for working alone or in a team-learning situation, with peers or with authority figures, and working under unstructured or structured conditions and with or without an adult.

(d) Physical factors such as the time of day, amount of mobility allowed in the learning situation, whether food can be consumed during learning, and, perhaps most importantly, whether information is presented verbally, in a written format, or in a 'hands-on' approach in which tactile and kinesthetic senses can be used.

(e) Psychological factors which include such things as analytic/global, reflective/impulsive and field dependent/field independent cognitive styles.

This inventory is computer scored by the publishers. The report can be done for an individual or for a group of individuals. The individual report lists a profile of the testee's responses that indicates which of the 24 separate factors the individual prefers to use when learning. The report also indicates where in the LSI Manual to find information on the appropriate way to teach the testee.

The LSI is one of the two or three most extensively researched instruments of those that were reviewed. The authors published a research report in 1976 and a user's manual in 1979 which detail the results of a number of studies dealing with the reliability and validity of this instrument. They reported that 56% of the test-retest reliabilities for the 24 factors were greater than .60. Overall, though, the reliabilities of the separate factors on this instrument appear to be quite low. The authors stated that they modified some of the questions for the factors with the lowest reliabilities in an effort to increase those reliabilities. No report of the success of those modifications was given, however. The authors also reported the results of a number of discriminant validity studies which successfully discriminated between high and low math achievers, gifted and nongifted students, learning disabled and nonlearning disabled students, and male and female students.

Dunn (1982) cited six research studies which purportedly found Aptitude by Treatment Interactions using factors or elements from this instrument. Those studies only dealt with four of the 24 factors, however. Thus, there is as yet, no evidence of the validity of the vast majority of the elements included in this instrument.

Productivity Environmental Preference Survey (PEPS) by Dunn, Dunn and Price (1982). This instrument is essentially an adult version of the LSI developed by the same authors and discussed immediately above. Its purpose is to identify how adults prefer to function, learn, and perform in their occupational or educational activities. This is a self report instrument

administered in a written format, on tape, or orally. It contains 100 items and takes approximately 25-35 minutes to complete.

This instrument is very similar to the LSI with the exceptions that many of the questions are worded differently, there are three fewer factors, and a Likert scale is used rather than a true/false format.

The test has four major content areas, each with a number of separate elements. They are:

1. Environmental factors which include such things as sound, lighting, temperature, and design conditions of the learning/performance environment.

2. Emotional factors such as levels of motivation, persistence, and responsibility, and the need for structure.

3. Sociological factors which include such things as the need for working alone or in a team situation, with peers or with authority figures, and working under unstructured or structured conditions.

4. Physical factors such as the time of day, amount of mobility allowed in the learning/working situation, whether food can be consumed during learning/working, and whether information is presented verbally, in a written format, or in a 'hands-on' approach in which tactile and kinesthetic senses can be used.

The authors published a user's manual in 1982 which details the results of a number of studies dealing with the reliability and validity of this instrument. They reported that 68% of the test-retest reliabilities for the 24 factors were greater than .60. The norm group consisted of 589 adults. The authors modified some of the questions for the factors with the lowest reliabilities in an effort to increase those reliabilities. No report of the success of those modifications was given. Also, in order to increase the discriminating power of some of the questions, the authors changed the

format from "true/false" answers to a five-point Likert scale. The authors also reported the results of a number of studies which have attempted to determine how various groups (e.g., young vs. elderly adults) differ on the PEPS scales. Little evidence dealing with the question of the validity of the instrument was provided.

Learning Styles Inventory: A measure of student preference for instructional techniques by Renzulli and Smith (1978). This instrument was designed for use with students in grades 4-12. The purpose of the instrument is to measure student attitudes towards nine general modes of instruction. The manual states that the major purpose of the test is to assist the teacher in individualizing instruction. This is a self-report inventory with items rated on a five-point scale from very unpleasant to very pleasant. The inventory can be administered verbally or in a written format. It has 65 items and takes approximately 30 minutes to complete.

The instrument examines the student's preferences for nine instructional practices which include the use of (1) projects, (2) drill and recitation, (3) peer teaching, (4) discussion, (5) teaching games, (6) independent study, (7) programmed instruction, (8) lecture, and (9) simulation. This test is computer scored by the developers. The test was designed to be used by an entire class of students at one time and the tests would then be submitted as a group. The computer report is quite thorough. It lists the mean scores for each student on each factor, as well as, how each student ranked the factors. The report also clusters students by preference for various teaching methods and includes a list of each student's profile.

The test items were selected through content and factor analysis techniques. The factor analysis resulted in the nine factors listed in the section above. Reliability estimates for each of the nine factors ranged from .66 to .77. These were derived from a study using 700 seventh and eighth grade students. Apparently, reliability estimates were not obtained on younger or older students.

The experimental validation study that the authors conducted used only three of the factors; lecture, discussion, and simulation. The results indicated that matching students with their preferred method of instruction in a social studies class resulted in significantly higher achievement and in more positive attitudes towards the class.

Your Style of Learning and Thinking by Torrance, Reynolds, Ball, and Riegel (1978). This instrument was designed to be used by students at the high school level and above. This is a self-report in which the testee selects one of three items which best describes the way that he/she thinks and learns. There are three forms (A, B, and C) appropriate for high school students through adults. The inventory has 40 items and takes approximately 20 minutes to complete. Each of the 40 items has one choice which corresponds to "left-brained" (logical, analytic, verbal), "right-brained" (visual-spatial, nonsequential, divergent), or combined "left and right brained" thinking.

The alternate forms reliability (Forms A & B) are .84 for right hemisphere specialization, .75 for left-hemisphere specialization, and .85 for the integrated style. These scores were based upon a sample of 50 col-

lege undergraduates. Test-retest reliabilities ranged from .84 for a sample of 20 college students to lower values (.47 to .55) in 3 studies which attempted to experimentally modify (make more creative or right-brained) the style of the participants.

The authors have attempted to validate the test in a number of ways. These include correlating the test with measures of creativity. The results of a number of studies reported in the manual indicated that the right brained scale correlates positively with measures of creativity, and the left-brained scale correlates negatively with creativity measures. Furthermore, the integrated scale did not correlate with the creativity measures, or, in a few instances, was negatively correlated. This latter finding was not explained. This instrument was also correlated with a test of self-directed learning readiness. As predicted, the right-brain scale correlated positively with readiness for self-directed learning, the left-brain scale correlated negatively, and the integrated scale was not correlated with the readiness measure. Finally, a study was conducted in which a group of students identified as highly creative were compared to a group which was presumably in the normal range of creativity. As predicted, the creative students scored significantly higher than the other group on the right-brain scale and significantly lower on the left-brain scale.

Learning Styles Inventory by Canfield and Lafferty (1976). This instrument was developed for use by individuals at the sixth grade level or higher, including people in business or industry. Although it is not explicitly stated in the manual, the purpose of this instrument is to enable teachers/instructors to more effectively teach individual learners by using

instructional techniques which match the style of the learner. This is a self-report inventory in which the testee ranks sets of four items as to their preference. There are 30 items in Form A and 25 items in Form B. The test takes approximately 30 minutes to complete.

This instrument covers 4 major categories of information related to the testee's learning style. These are:

1. Conditions - This category includes 8 sub-areas which reflect characteristics of the learning environment. The names and descriptions of each of these are listed below.

   a. Peer - preference for working with others.
   b. Organization - preference for very clear, explicit statements of what is expected of the learner.
   c. Goal Setting - preference for setting one's own learning goals.
   d. Independent - preference for working alone on learning projects.
   e. Competition - prefers to compare own performance to that of other learners.
   f. Authority - preferring an authoritarian, disciplined learning environment.
   g. Instructor - desires a warm, friendly, approachable instructor.
   h. Detail - prefers to have very specific learning assignments.

2. Content - this category includes information about the types of subjects the learner is interested in. These include:

   a. Numeric - enjoys working with numbers and logic.
   b. Qualitative - enjoys working with language (writing, reading, speaking).
   c. Inanimate - prefers working with things (repairing, designing, building).
   d. People - enjoys working with people.

3. Mode - This category deals with the mode of information gathering preferred by the learner. These include:

a. Listening - prefers lectures, tapes, speeches.
b. Reading - prefers to gain information by reading texts, pamphlets, manuals.
c. Iconic - prefers using graphs, movies or other visual material to learn.
d. Direct experience - prefers handling materials to learn about them.

4. Expectation - This category refers to the learner's expectancy that he/she will be successful at the learning task.

a. "A" - expects to achieve an outstanding level of performance at the learning task.
b. "B"- expects to achieve a good level of performance.
c. "C"- expects to perform at an average level.
d. "D" - expects to perform below average or unsatisfactorily.

The expectancy score can be viewed as the students' prediction of how well they could do.

The manual reports scale reliabilities ranging from .59 to .92 based upon a sample of 369 community college students. Split-half reliabilities were all above .95. No test-retest reliabilities were reported. There are separate norms for males and females on this instrument. There are also separate norms for different age groups.

The manual lists the results of several studies which have been conducted in an effort to validate this instrument. The results of several studies were positive in that they suggest that this instrument is valid. There was one study, however, which found no support for its validity.

C.I.T.E. Learning Styles Inventory by Babich, Burdine, Albright, and Randol (1976). This instrument was designed for use with school children.

The reliability studies were done using seventh, eighth, and ninth graders. Its purpose is to help teachers identify the learning styles of their students. This instrument consists of self-report items using a 4-point scale indicating "least like me" to "most like me" for each statement. The instrument uses a written format. It has 45 items and takes approximately 15-25 minutes to complete.

The instrument focuses on three main areas: 1) how the student gathers information (auditorily, visually, with language, numerically, or kinesthetically), 2) the student's preferred working conditions (alone or with others), and 3) his/her expressive preferences (verbal or written).

A large-scale reliability study (n=2229) was conducted with this test in the Wichita, Kansas school district. Split-half reliabilities were classified by the percentage of items which fell within a specified range. For the final version of the instrument, 4% of the items had reliabilities between .40 and .50, 23% had reliabilities between .5 and .6, 40.7% had reliabilities between .6 and .7, 29.6% ranged from .7 to .8, and 3% were above .8. The manual did not report any evidence of validity studies. The school district in which the instrument was developed did not have sufficient funds for further testing or development.

Learning Interaction Inventory by Jacobs and Fuhrmann (1980). This instrument appears to be intended for high school and college level students. It was designed to assist teachers in collecting information about student's preferred learning interaction styles. The instrument assesses the degree to which students prefer to act independently, dependently, or in

collaboration with the teacher in a learning situation. This is a self-report in a written format. It has 40 items and takes approximately 40 minutes to complete.

This test assesses the degree to which individuals think that they can be successful at learning in situations where they are required to interact in a dependent manner, in an independent manner, or in a collaborative manner. These are defined as follows:

> Dependence (D) in the learning situation refers to instances in which the learner has successful experiences with the teacher controlling the learning activities and having the responsibility for insuring that learning takes place.
>
> Independence (I) refers to the situation in which the learner has had positive experiences in which he or she has had the responsibility of controlling the learning activities. The teacher is seen as an "expert" who assists the learner in achieving the educational goal.
>
> Collaborative (C) learning refers to cases where the teacher and student(s) share the responsibility for learning.

The Research Report for the instrument describes a number of studies which were conducted in order to establish its reliability and validity. In general, these studies were well designed but used very small numbers of subjects. The test-retest reliabilities were .63, .67, and .72 for the Independent, Collaborative, and Dependent scales, respectively. The evidence for the validity of the instrument suggests that it has face validity but the evidence for other forms of validity are weak at this time.

Grasha-Riechmann Student Learning Style Questionnaire by Grasha and (Riechmann) Hruska (1975). This instrument was designed for use with college students. The purpose of the instrument was to serve as a research tool to study the effects of matching student learning styles with a compat-

ible teaching style and to learn how diverse teaching styles or formats affect individuals with different learning styles. This is a self-report inventory on which an individual indicates the degree to which statements apply to oneself. The test is taken in a written format. It has 90 items and takes approximately 45 minutes to complete.

This instrument attempts to determine how a learner interacts with the teacher, other students, and the learning of content from different courses. This instrument has 6 scales which include: Independent, Dependent, Participant, Avoidant, Collaborative, and Competitive. The Competitive and Collaborative scales primarily refer to the degree to which the students like to share ideas and talents in a learning situation. The Avoidant and Participant scales refer to the degree to which students prefer the traditional classroom format. The Independent and Dependent scales primarily refer to the amount of intellectual curiosity and initiative the student possesses.

The authors reported test-retest coefficients ranging from .76 to .83 for the different scales (n=269). There have apparently been only a small number of studies conducted in an attempt to validate the instrument. The best evidence for its validity comes from a study conducted by Andrews (1981) which suggested that students benefit from being in a learning environment which is compatible with their learning style. For instance, that study found that students that were high on the collaborative scale reported that they generally benefitted from being in a peer-centered chemistry discussion section.

The Learning Style Inventory: A self diagnosis tool for adults to assess learning style preferences by Silver and Hanson (1980). This instrument was designed to help adults determine their learning style preferences. It has a written format and requires the testee to rank sets of four words which are called "self descriptors." It has 20 items and takes approximately 20-30 minutes to complete.

This instrument is based on the Teaching-Learning-Curriculum Model developed by the authors. This model was derived from Carl Jung's theories of personality types. The instrument attempts to identify the locus of an individual on two inter-dependent dimensions dealing with: 1) perceiving (sensing and intuiting) and 2) making judgements (thinking and feeling).

The manual does not discuss any research findings related to the reliability or validity of this instrument.

Learning Style Inventory by Kolb (1976). This instrument was designed to be used by college students and adults. It was created to measure the individual learning styles derived from experiential learning theory. The latter categorizes people on their emphasis on four learning modes:

1. Concrete Experience (CE)
2. Reflective Observation (RO)
3. Abstract Conceptualization (AC)
4. Active Experimentation (AE)

This is a self-report administered in a written format. The test booklet includes instructions on how to score and interpret the results. It has nine items and takes approximately 20 minutes to complete.

Experiential learning theory assumes that individuals must use these four abilities (CE, RO, AC, AE) in learning situations. The theory further assumes that there are two primary dimensions that incorporate these abilities. The first dimension represents concrete experience on one end and abstract conceptualization at the other. The other dimension has active experimentation (AE) at one end and reflective observation (RO) at the opposite pole. The theory assumes that learners tend to use one of the abilities at one end of each of these dimensions and that the particular combination an individual uses comprises one's learning style. There are four styles possible with the model. It is assumed that an individual's learning style can be modified with experience.

This instrument has been fairly heavily researched with a number of validity and reliability studies reported. Split-half reliabilities ranged from .55 to .82 for each of the factors. These values were obtained by averaging across five separate studies. Test-retest reliabilities ranged from .49 to .60 for the different factors. These latter estimates were also averaged across studies and the elapsed time between tests ranged from 1 to 7 months. The manual details the results of a number of correlational studies done in an effort to validate the instrument. These include studies in which the LSI was correlated with performance measures for particular types of learning environments. The manual reports that some of the predictions derived from the theory were confirmed although additional information needs to be collected. The rationale for some of the comparisons discussed in the manual was unclear but the manual includes a large bibliography listing articles related to the reliability and validity of this instrument.

Cognitive Style Mapping by Joseph Hill (1971). This instrument appears to be one of the first learning style measures developed. In this approach the learner is assessed on 27 different variables relating to three main factors: 1) how the student takes in information, 2) how the student's learning is affected by others, and 3) how the student reasons or processes information. The instrument appears to have been targeted for high school level students and above. Kirby (1979) defined Hill's main purpose in developing this instrument as a desire to match the learner with an optimum learning environment to make learning less problematic. The entire instrument takes approximately three hours to take and consists of over 200 self-report items. For each of the 27 variables in the instrument the student is given a rating of "major", "minor", or "negligible", indicating the importance of each factor to the student.

Kirby (1979) criticized the instrument for the lack of evidence suggesting adequate reliability. A major study conducted by the American College Testing Program (1977) in an effort to validate this instrument resulted in negative findings. Claxton and Ralston (1978) also criticized the instrument for having little evidence of reliability or validity. The current status of the instrument is somewhat in question at present because the institution at which it was developed, Oakland Community College in Bloomfield Hills, Michigan, no longer provides scoring services for this computer scored instrument.

Conceptual Level Assessment (Using the Paragraph Completion Method) by David Hunt (1973). The purpose of this instrument is to describe the student in terms of the educational conditions under which he or she is most

likely to learn. Hunt (1979) states that this instrument describes how a student learns, not what he or she has learned. The paragraph completion method is described as a semi-projective method consisting of six items used to assess conceptual level. Hunt considers the responses to be examples or samples of thought processes which indicate how a person thinks. Scoring is done by the teacher and requires use of clinical judgement.

The instrument requires the testee to complete six paragraphs which deal with two topics: 1) how the individual handles conflict or uncertainty, and 2) what the individual thinks about rules, structure, and authority relations. The testees are encouraged to write at least three sentences on each topic. Younger persons, grades 6-13, are allowed three minutes per paragraph, whereas older persons are allowed just two minutes per paragraph.

This instrument is designed to measure the amount of structure a student requires to learn best. Individuals low in conceptual level are considered to need a very highly structured learning environment with clear, consistent instructions on what is to be done and how to do it. The higher the conceptual level an individual has, the greater the degree of independence and self-reliance that individual is seen to have. Thus, individuals with high conceptual level can be allowed a great deal of autonomy in a learning situation. Hunt defined structure as how much the teacher is responsible for the learning activity. Highly-structured environments are teacher centered, use preorganized materials, and involve very specific instructions and expectations, whereas low-structured situations are more likely to be determined by t· student, involve general instructions, and include materials which are not preorganized.

Hunt, Butler, Noy, and Rosser (1977) reported test-retest reliabilities of .67 for 36 college students over a three month interval. Test-retest reliabilities over a one year interval range from .45 to .56. Inter-rater reliability coefficients obtained from a number of research projects were quite high, the majority being .8 or above. Conceptual level has been found to have a low positive correlation with IQ or other ability measures. Hunt, et al. interpret this finding as evidence that conceptual level is distinct from IQ or general ability. The manual for this instrument presents no information dealing with the issue of validity.

APPENDIX B

Purchasing Information About the Learning Styles Assessment Instruments

****

LEARNING STYLE INVENTORY (LSI) by
Rita Dunn, Ed.D.,
Kenneth Dunn, Ed.D.
Gary Price, Ph.D.

This instrument is available from:
Price Systems
Box 3271
Lawrence, KA 66044
ph: (913) 843-7892
The cost is $9.50 for 30 reusable test booklets. Score sheets are $5.50 for 60 and scoring is $4.00 per individual, less if several tests are scored at once. The manual is $9.50 and a specimen set is $12.00.

****

LEARNING STYLES INVENTORY: A MEASURE OF STUDENT PREFERENCE FOR INSTRUCTIONAL TECHNIQUES
developed by Joseph S. Renzulli
and Linda H. Smith
Copyright 1978

This instrument can be obtained from:
Creative Learning Press, Inc.
P.O. Box 320
Mansfield Center, CT 06250

A set of 30 student forms is available for $18.50 - this apparently includes the price of scoring the tests. The manual is $6.95 and a specimen set is available for 7.50.

****

YOUR STYLE OF LEARNING AND THINKING
developed by E. Paul Torrance, Cecil Reynolds, Orlow E. Ball, and Theodore Riegel

We obtained the manual, which contains copies of the instrument, from:
Dr. E. Paul Torrance
Department of Educational Psychology
The University of Georgia
Athens, GA 30602
It was available for the price of duplication of the materials ($3.00 at the time we obtained it).

****

****

LEARNING STYLES INVENTORY
developed by Albert A. Canfield, Ph.D.
Copyright 1976

This instrument is available from:
Humanics Media
Liberty Drawer 7970
Ann Arbor, MI 48107

****

PRODUCTIVITY ENVIRONMENTAL PREFERENCE SURVEY (PEPS) by
Rita Dunn, Ed.D.,
Kenneth Dunn, Ed.D.
Gary Price, Ph.D.
Copyright 1979, 1982 by Price Systems, Inc.

This instrument is available from:
Price Systems
Box 3271
Lawrence, KA 66040
ph: (913)843-7892
The cost is $9.00 for 30 reusable test booklets. Score sheets are $8.00 for 100 and scoring is $4.00 per individual answer sheet, less if several are scored at once.

****

C.I.T.E. LEARNING STYLES INVENTORY
developed by Babitch, Burdine, Albright, and Randol of the Teacher Center, Wichita Public Schools in 1976.

This instrument is available without charge from:
Wichita Public Schools
Murdock Teacher Center
670 North Edgemoor
Wichita, KS 67208
The instrument is also contained in the following publication:
Puzzled About Educating Special Needs Students?
published by:
Wisconsin Vocational Studies Center
University of Wisconsin-Madison
Madison, WI 53706

****

****

LEARNING INTERACTION INVENTORY
developed by: Ronne Jacobs and Barbara Fuhrmann
Copyright 1980

Available from: Ronne Jacobs Assoc.
401 September Drive
Richmond, VA 22091

Cost: The inventories sell for $2.50 each. This includes a self-scoring booklet.

****

GRASHA-RIECHMANN STUDENT LEARNING STYLES Questionaire
Developed by Anthony Grasha & Sheryl (Riechmann) Hruska
Copyright 1975

The instrument is available from:
Anthony Grasha
Faculty Resource Center
University of Cincinnati
Cincinatti, OH 45221
We do not know the price, if any.

****

THE LEARNING STYLE INVENTORY: A SELF-DIAGNOSIS TOOL FOR ADULTS TO ASSESS LEARNING STYLES PREFERENCE
developed by Harvey F. Silver & J. Robert Hanson
Copyright 1980

Available from: Hanson-Silver Assoc., Inc
Box 402
Moorestown, NJ 08057
The cost is $55.00 for the User's manual and 30 copies of the instrument. Additional copies of the instrument are $3.50 each.

Note: These authors also market an instrument designed for use with high schocl students. This instrument is briefer, is also self scored, and includes a third personality dimension - introversion/extroversion.

****

****

LEARNING STYLE INVENTORY
developed by David A. Kolb
copyright 1976

Available from:
McBer and Company
137 Newbury Street
Boston, MA 02116
(617) 437-7080

The manual is $10.00. The self-scoring booklet in packets of 10 is $30.00. Individual test sheets are $6.25 for a pack of 25 as are individual scoring sheets. A plastic scoring template is $5.00. The McBer company will score the tests for $1.50 each.

****

ASSESSING CONCEPTUAL LEVEL WITH THE PARAGRAPH COMPLETION METHOD.
developed by David Hunt, L. Butler, J. Noy, and M. Rosser.
Copyright 1978.

This instrument in is available from:
Publication Sales Department.
Ontario Institute for Studies in Education
252 Bloor Street West
Toronto, Ontario, Canada, M5S 1V6
Telephone: 923-6641

The manual costs $4.50.

****

COGNITIVE STYLE MAPPING
developed by J. D. Hill and associates.

This instrument was developed at the:
Oakland Community College
Bloomfield Hills, MI 48013

This instrument is computer scored but the developers at Oakland Community College have stated that they can no longer afford to provide scoring services to other facilities. It is suggested that if you are interested in this instrument that you contact the people in Bloomfield Hills and talk to them about using their instrument.

****