A MODEL FOR EVALUATING AND CHOOSING AMONG WIDELY USED ASSESSMENT INVENTORIES OF COGNITIVE/LEARNING STYLE: AN EXPLORATORY DELPHI STUDY

By

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ABSTRACT

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WIDELY USED ASSESSMENT INVENTORIES
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The purpose of this research is to add to the existing body of knowledge about learning/cognitive style assessment inventories. Very little research has been done in which inventories of cognitive/learning style have been evaluated, compared, and contrasted. Practitioners often have a difficult time choosing among the different inventories of cognitive/learning style when selecting an inventory that best meets their instructional needs.

The methodology of the study was a Delphi technique utilizing descriptive statistics to analyze the findings. Three Delphi rounds were sent to 41 experts in the field of cognitive/learning style. After each round data were analyzed and sent back to the experts in order for them to arrive at consensus.

The results of the study indicated that:

1. Experts were able to identify 30 published inventories which they perceived as being widely used.
2. Experts were able to identify and rank a group of elements that they perceived as important elements to differentiate effectively and efficiently among

inventories of cognitive/learning style.

3. Experts were able to identify and rank in order of importance 42 elements or characteristics of cognitive/learning style inventories.

4. Experts were able to identify and rank reasons for using cognitive/learning style inventories and their disappointments with cognitive/learning style inventories.

5. The Delphi methodology is an appropriate technique for this type of study.

6. There is some confusion about the definition of cognitive/learning style, and how cognitive/learning style should be measured.

7. A model has been built, using the data from the experts, that will aid practitioners in selecting a cognitive/learning style inventory that could best suit their instructional needs.

DEDICATION

This dissertation is dedicated to my son:

MARC GENSHAW

Who has taught me that to dream a dream

is more than half way to achieving a reality

ACKNOWLEDGEMENTS

I wish to express my sincere respect and appreciation to Dr. Peggy Riethmiller, chairperson of my doctoral committee. Dr. Riethmiller provided valuable advice, direction, and assistance. She generously gave of time to help me complete this project on schedule. Also I wish to thank Dr. Castelle Gentry. He gave unstintingly of his time and expertise to help me run the Delphi Survey. I wish to thank Dr. Ben Bohnhorst and Dr. Casmer Heilman for their suggestions to improve and strengthen this dissertation. Without the strong support of my committee, this dissertation would have never been completed.

I extend my grateful appreciation and love to my family and friends for their constant support and assistance. I especially want to thank Karlene Rabidoux who helped to proofread and edit this dissertation, and provided invaluable encouragement during crucial periods of this project. Additionally, I want to thank Ann Harlan who listened when I needed a friend and made valuable suggestions. I wish to thank my mother and father who started me on the road to my education, and believed that I could accomplish this task. Finally, and most importantly, I wish to thank my son who has been with me through all the ups and downs of writing this dissertation.

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CHAPTER 1

INTRODUCTION

The purpose of this dissertation was to add to the existing body of knowledge on cognitive/learning style assessment inventories. Additionally, using results from a Delphi Study conducted with experts in the field of cognitive/learning style assessment inventories, a model was built to aid practitioners in selecting an inventory to meet their instructional needs.

How students learn has been an educational question for as long as there have been teachers and learners. Every great educator has recognized and tried, to some degree, to accommodate differences in learning. Aristotle used association and mnemonic devices. Plato used dialogue with questions and answers to stimulate the learning process. The Greeks recognized differences in learners by classifying personalities as sanguine, choleric, melancholic and phlegmatic (Cornett, 1983, p. 7). More recently Jerome Bruner pondered if there may be innate ways of organizing material. Bruner asked the basic questions of education "...What shall be taught, when and how?"(Bruner, 1960, p. 2). Bruner also felt that schooling should help each student to achieve their optimum intellectual development.

> This is not to say that the pace or the content of courses need be identical for all students...Careful

> investigation and research can tell us wherein differences must be introduced. One thing seems clear: if all students are helped to the full utilization of their intellectual powers, we will have a better chance surviving as a democracy in an age of enormous technological and social complexity (Bruner, 1960, p. 9-10).

Gagne stated the obvious when he said, "The central purpose of any program of education is to promote learning" (Gagne, 1975, p. 1). He stated that, in order to promote learning, the teacher must be the manager of education and must effectively deliver instruction to the student by using any medium (oral, written, etc.) in order to arrange conditions so every student learns what he is intended to learn (Gagne, 1975, p. 4).

One way to optimize learning is to adjust instruction to match learners' cognitive/learning styles. Teachers could measure students' styles by using cognitive/learning style assessment inventories. They are considered by many to be powerful tools in aid of the instructional process. This research investigated widely used cognitive/learning style assessment inventories. Review of the literature, expert opinion using the Delphi Technique, and surveying the actual inventories were the methods used in this investigation.

STATEMENT OF THE PROBLEM

The problem this researcher addressed was the difficulties which practitioners have in making informed choices among the many assessment inventories of cognitive/learning style available. In this study, cognitive/learning style was defined as: "The characteristic cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environments" (NASSP, 1979, p. 4).

In this research, the term cognitive/learning or learning/cognitive style was used because practitioners and experts in the field use one or both terms, and there is very little consensus as to what is the best term to describe the phenomenon. Although distinctions have been made among learning, cognitive, and educational styles, in this research, these terms are used interchangeably. Experts, and others using the inventories, tend to use the term with which they are most familiar.

In 1981 the NASSP and St. John's University of New York cosponsored a conference for practitioners and scholars interested in cognitive style, learning style and brain behavior. James Keefe, writing about this conference, referred to the area they were studying as cognitive/learning style (Keefe, 1988, p. 2). The task force formed as the result of this conference reviewed 40 broad elements of cognitive/learning style and brain behavior. From the initial list of 40 elements, 20 were chosen to be included in an assessment instrument which was developed by the NASSP group titled Learning Style Profile. The preceding NASSP definition was also developed at that time.

Although Keefe used the term cognitive/learning style to describe what was being reviewed in the 1981 conference, he and the NASSP group that developed the assessment instrument chose to use the term learning style to describe the instrument. In this research, the broader term cognitive/learning style assessment inventory will be used. In this way the duality of terms used by practitioners and researchers will be addressed.

ELABORATION OF THE PURPOSE OF THE STUDY

Very little research has been done which has compared, contrasted and evaluated information about the different assessment inventories of cognitive/learning style. In order to bring some order, clarity, definition, and unity to the area of style assessment inventories it is this researcher's aim to bring together information about several of the most widely used instruments. Although models have been developed to clarify the construct of cognitive/learning style, only very limited models have been developed which evaluated assessment inventories of style. The goal of this research is to give the practitioner a practical tool to use to select a specific cognitive/learning style assessment tool for a specific need.

Examples of some different uses for cognitive/learning assessment inventories are aiding a teacher in selecting materials that would most effectively present a reading unit to learning disabled students, giving incoming university students insights about how they learn best so they could adjust their own learning experiences, and aiding an administrator to determine supplemental materials that might benefit the majority of the students in a district to learn more effectively. It is likely that the same practitioner might select different inventories for each one of these uses.

To reiterate, the aim of this research is to provide a means to assist the practitioner in this selection process. This study was designed to evaluate several popular cognitive/learning style assessment inventories, as well as provide a model which practitioners could use to guide their evaluation of style assessment inventories.

NEED FOR THE STUDY

Research in this area is needed because assessment instruments of cognitive/learning style are very different. They vary in content, purpose, and how results are measured and evaluated. One of the reasons there has been so much confusion is that there have been two major lines of research into cognitive/learning style. One line of research has been by psychologists, and another line of research has been by educators. The two groups have developed their own terminology and definitions to describe cognitive/learning style (Blakemore et al., 1984). Psychologists frequently have used the term cognitive style to describe their research about style, and educators frequently have used the term learning style to describe their research about style. Style characteristics measured by psychologists and educators through style assessment inventories often overlapped, but the terminology to describe the characteristics of style was often different. For example, assessment inventories developed by psychologists which measure style often measured style factors called field dependence/independence, reflective/impulsive, complexity/simplicity and analytic/nonanalytic. On the other hand, assessment inventories developed by educators often measure style factors which deal with preferences for different kinds of social structure, physical environments, and personality characteristics which influence learning. Guilford (1980) summed up much of the difficulty with the research on cognitive/learning styles and with the instruments used to measure styles. He felt what was referred to as cognitive (learning) style was actually a whole range of different kinds of dimensions: some had to do with ability, some with higher order functions and others with preferences. Because of the variance and confusion about the definitions and terminology in style assessment instruments, the practitioner is at a real disadvantage when trying to decide which assessment instrument to use.

RELEVANCE OF THE STUDY TO THE FIELD OF EDUCATION

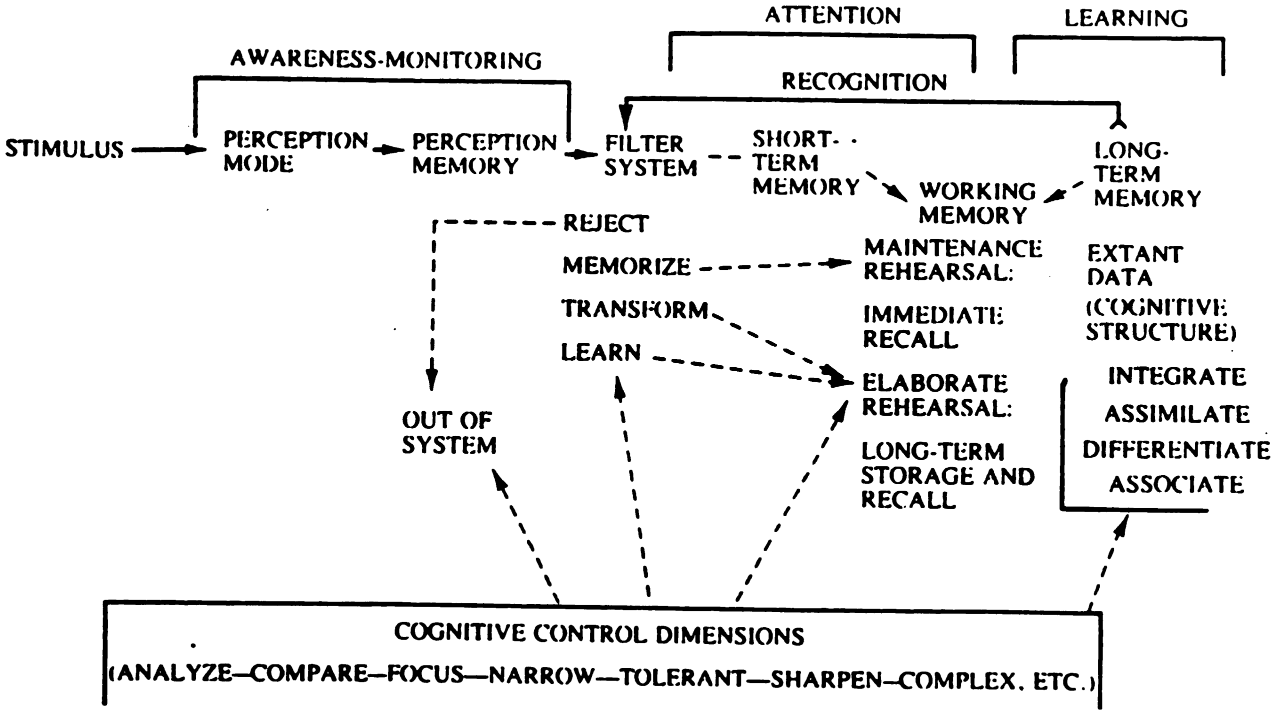
"The central purpose of any program of education is to promote learning" (Gagne, 1975, p.1). Learning occurs when the learner is presented with information, receives the information and somehow stores the information for further use. In his model of Information Processing Charles A. Letteri graphically represents this process as presented in Figure 1 (Letteri, 1988, p. 24).

According to this model, after the presentation of the stimulus, the information goes through the learner's unique cognitive processing process. "The learner is central to this cognitive definition of learning. The responsibility for engaging the learning process belongs to the learner alone. The student must understand the learning process and how to control and direct it."(Letteri, 1988, p. 23)

The Letteri Model diagrams the background and characteristics learners bring to the learning situation which influence what will be learned and how it will be learned. The concept of cognitive/learning styles is one way psychologists and educators have tried to define the background and characteristics that the learner brings to the learning encounter.

Cognitive/learning style assessment inventories have been developed in order to diagnose individual style. Keefe (1988, p. 2) contends that diagnosis is the most neglected function of schooling and that style is the least understood

Figure 1. Information Processing, General Operations.
Charles A. Letteri, 1982



element of diagnosis. This may be true, but it is not for the lack of assessment inventories. Using only 7 reference materials on cognitive/learning styles, (Blakemore et al., 1984; Cornett, 1983; Curry, 1987; De Bello, 1988; Keefe, 1988; NASSP, 1982; NASSP, 1979) this researcher counted 56 published inventories on styles. There were also "in house" unpublished inventories (Cornett, 1983). Because of the large numbers of cognitive/learning style assessment inventories, the lack of available research about how to choose appropriate inventories, and the confusion about what is cognitive/learning style, practitioners may have often found it difficult to select inventories for their educational needs. In this research, experts in the field of cognitive/learning style assessment inventories have contributed information used to develop a model to assist practitioners in choosing an assessment inventory which best suits their instructional needs. If the best assessment inventory is chosen, then presumably more accurate data about students' learning preferences will be obtained, and more optimal learning situations might be structured. This research is relevant to the field of education because it might aid practitioners in selecting an assessment inventory to help them structure a more optimal learning environment for individual students.

THEORETICAL BASE FOR THE STUDY

Learning is a term used frequently in this study. It is beyond the scope of this research to make explicit the foundations of the theory of learning. However, it is important to the understanding of this study to outline the definition and theory about learning used by this researcher.

> There is no accepted single definition of what learning is. Some theorists are interested in overt behaviour, others in inferred mental processes. Some focus on the stimuli which are said to lead to molecular behaviour, others on the shaping and control of patterns of behaviour which constitute action in the environment. Some are concerned with strategies for teaching while others seek to facilitate self-discovered learning. Thus we are faced with an area of knowledge with very wide and flexible boundaries (Jones, 1982, p. 2).

However, there are three criteria that psychologists have traditionally used to define learning. These criteria are: (1) there must be some change in behavior,(2) the change must be relatively stable, and (3) the change must result from experience (Zanden & Pace, 1984). Gagne (1970) restated these criteria in his definition of learning. "Learning is a change in human disposition or capability, which can be retained, and which is not simply ascribable to the process of growth" (3). Futhermore Gagne stated that the change of performance was the indicator that learning has occurred and change could be measured by looking at the subject's performance before and then after being placed in a learning situation. These criteria for determining and defining learning are the ones used in this study.

Flowing from the criteria and definition of learning described above was the definition of learning style developed by Keefe and Languis and adopted by the NASSP Task Force.

> ...the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment. It is demonstrated in that pattern of behavior and performance by which an individual approaches educational experiences. Its basis lies in the structure of neural organization and personality which both molds and is molded by human development and the learning experiences of home, school, and society (Keefe & Languis, 1983, p.1).

The concept of cognitive/learning style was developed because of the recognition that learners came to the learning task with different ways of knowing and learning. That learners filter information using their own perceptions has been known for a long time. Bruner and Postman (1949) in their article about perception, cognition, and behavior concluded, "As we have thought about the matter, it becomes increasingly clear that a thoroughgoing psychology of perception imbedded in a thoroughgoing general psychology must inquire into all the conditions... how, in short, the organism by perceiving comes to adapt to the external, distal stimulus" (p. 29). Schlesinger (1953) of the Menniger Foundation outlined how important individual differences were in an early study of cognitive organization. His conclusion from this study was:

> Many studies have documented the growing conviction that perception in general can be influenced by motivational and situational factors. It is the primary purpose of this paper to show that the search for such generalized relationships bypasses an important source of variables

> which condition these relationships. This sources is the person himself and the way he is organized to perceive-or more generally, his cognitive organization (p. 354).

Gardener (1953), who was also from the Menniger Foundation, described individual differences of organizing and experiencing stimulus which he labeled as the individual's style. Piaget believed, "Cognitive acts are seen as acts of organization of and adaptation to the perceived environment" (Wadsworth, 1971, p. 9). Even though psychologists disagree about what constitutes learning and which learning theory is correct, one of the things they all do agree upon is the existence of individual differences in learning (Dubin & Okun, 1973). Bentov (1977) summed up the filtering process in his theory of relativity.

> The theory of relativity emphasizes the notion that no matter what we observe, we always do so relative to a frame of reference that may differ from someone else's, that we must compare our frames of reference in order to get meaningful measurements and results about the events we observe (p. 3).

The terms cognitive or learning style(s) were developed to define the concept of individual differences in learning and knowing.

> Elements of learning style appeared in the research literature at early as 1892....Even before 1900 Cattell and Jostrow attempted to relate differences in perceptual mode to general intelligence and learning performance without success. Vernon, Eysench, and others described perceptual topologies such as analyzers vs. synthesizers and color vs. form reactors.
>
> The term 'cognitive style' was coined by Allport in 1937 to refer to a quality of living and adapting influenced by distinctive personality types. In the 1940's Thurstone and later Guilford identified factors of perceptual speed and flexibility....

> Specific research on cognitive styles was greatly expanded after World War II at Brooklyn College, the Menniger Foundation, and the Fels Institute (Keefe, 1979, p. 4-5).

In 1954 Witkin (1977) was doing research on field dependence/independence, and by 1960 several psychologists and some educators were researching cognitive/learning styles. As new constructs of cognitive/learning style were identified, cognitive/learning assessment inventories were developed. The assessment inventories were used to decide if the construct existed and/or the parameters of the construct, and were also developed as a tool for practitioners to determine cognitive/learning style differences among learners. Most of the authors of the inventories formulated a rationale for cognitive/learning style and the cognitive/learning style construct they developed. As part of constructing a model for practitioners, this researcher examined some of these rationales and has presented them in subsequent parts of this work.

In this study a model was constructed to help practitioners choose a cognitive/learning style assessment inventory. For the purposes of this study, the meaning and function of the word model was based on writings by Paul C. Nutt (1984) and Leslie J. Briggs and Walter W. Wager (1980). According to Briggs and Wager, "The word 'model' refers to a particular organized set of procedures for actually carrying out a problem-solving process for a particular purpose" (p. 4). In this study a flowchart and a set of matrices were developed as the organized set of procedures for carrying out the problem-solving process of choosing an appropriate cognitive/learning style assessment inventory. According to Nutt (1984) the reason a model is used is to give the planner (in this study the practitioner) pictures of several possible solutions (cognitive/learning style assessment inventories).

> The model aids in the conceptualization process by offering the planner various ways to view the problem. The planner uses the structure to pose competing ways to deal with the problem and to draw out the implications of each.....The model helps the planner list, merge, and define key elements that must be considered. The model permits the planner to detail key functions so an assessment of workability can by made. Finally, models provide a coordinational device. They allow the planner to illustrate options, gain sanction, and communicate preliminary ideas to key parties (Nutt, 1984, p. 170).

Additionally, according to Nutt, models could reduce costs by acting as a surrogate for pilot programs. In this study, if teachers and administrators used the model, and thus were able to narrow their choices down to one or two appropriate cognitive/learning style inventories then they might be able to avoid the expense of buying all the inventories or the wrong inventory.

Nutt used the term nova models to designate new representations of solutions to problems. A nova model is a custom made model to fit a specific situation rather than a historical model which is a model built on the practices of others. Nova models are built from the basic questions that undergird the problem. The model in this study was a nova model. This researcher started with basic questions such as, what is cognitive/learning style, and then asked for responses for the questions until consensus was achieved. A model which fits the specific need of choosing a cognitive/learning style assessment inventory was developed from this consensus. A crucial element when developing a nova model is to use creativity techniques such as the Delphi instrument (discussed in Chapter 2). A Delphi methodology was used in this study to stimulate creativity and develop new solutions.

RESEARCH QUESTIONS

Primary Research Question

What process might practitioners follow to reliably select cognitive/learning style assessment inventories that effectively match their needs?

Subquestions

1. Which cognitive/learning style inventories are perceived as being widely used?
2. What elements of cognitive/learning style inventories are perceived to differentiate effectively and efficiently among widely used inventories?
3. Are some elements in widely used cognitive/learning style inventories perceived as more important than other elements?
4. What is the perceived range of elements of cognitive/learning style inventories in terms of

their respective importance?

5. What elements are perceived as important for a model that assists practitioners in selecting an appropriate cognitive/learning style inventory?

LIMITATIONS OF THE STUDY

Limitations of the study are related to the population, the methodology, and the procedures of the study.

The population was made up of experts in the field of cognitive/learning style assessment inventories. It was not a randomly drawn sample. It was drawn from people who have published and given presentations about cognitive/learning style assessment inventories. They are made up mostly of university professors. Another limiting factor about the sample was that the respondents had to agree to participate in a study that required 30 to 60 minutes of their time for three separate rounds over a span of several months. Some of the experts contacted chose not to make that kind of commitment. Finally, because the sample was drawn from a population of experts the pool was limited in size (Round 1=36 experts, Round 2=33 experts, Round 3=29 experts).

The Delphi methodology, which was used, may be open to semantic difficulty in communication. The open ended questions posed in each round tend to make it difficult to formulate unbiased next round questions. Because opinions are what were being sought, quantification of responses may

leave some results open to various interpretations.

A further limitation is the number of missing cases. Each succeeding Delphi Round required more of the respondents' time because each questionnaire was longer and more complex. The number of returned results diminished from round to round. Also it took approximately seven months from the initial phone contact to the mailing of Round Three. This time frame went from February 1990 to September 1991, which covered two academic years. Some of the experts lost interest or moved during this period of time.

Lastly this Delphi was several pages in length. Because of its length, it is quite possible that the last questions may not have received the same kind of attention as the first questions received.

ORGANIZATION OF THE STUDY

The study is organized as follows:

Chapter 1 states the problem and purpose of the study. It also details the need for the study, and how the study adds to the field of Education. Research questions are presented. The scope and limitations of the study are given.

Chapter 2 reviews the literature on the Delphi technique, cognitive/learning styles, and cognitive/learning style assessment inventories.

Chapter 3 details the design of the study. It includes the research population and the sample, the instrumentation, the data collection, the procedures, and the plan for analyzing the data.

Chapter 4 reports the data analysis and the summary of the findings for each research question.

Chapter 5 presents the study conclusions. It includes a brief summary of Chapters 1 through 4. There is a presentation of the findings, the conclusions, and recommendations growing out of the study.

SUMMARY

In this chapter, the researcher stated the problem for this study. The stated problem was: What process can practitioners follow to reliably select cognitive/learning style assessment inventories that effectively match their needs? The given purpose in this study was to develop a tool practitioners could use in order to effectively choose among widely used assessment inventories. Additionally, a need for the study was established by demonstrating the confusion in the literature about the meaning of cognitive/learning style and how to measure it.

Relevance of the study to the field of education was highlighted by defining certain goals of education and by presenting the concepts included in the Letteri _Model of Information Processing_. The theoretical base of the study resides in learning theories, cognitive/learning style theories, and model theories which were used in this research. Additionally, a brief history of the development of the concept of cognitive/learning style was presented.

The research questions were also presented. Limitations related to the population, the methodology, and the procedures of the study were cited. Finally the organization of the 5 chapters in this study were described.

CHAPTER 2

REVIEW OF THE LITERATURE

INTRODUCTION

The first part of this literature review investigates the Delphi technique. This is the methodology of this research. It undergirds and structures the research. Areas of the Delphi technique that are discussed are: definitions of the term Delphi technique; history, purposes, and philosophy of the technique; the process of the technique; disadvantages, limitations and problems with the technique; and advantages and applications of the technique. The second part of the literature reviews the elements of cognitive/learning style and the inventories that measure style. Areas that are explored are: definitions of cognitive/learning style, applications of cognitive/learning style to learning situations, and assessment inventories of cognitive/learning style.

The Delphi Technique

The methodology of this research is the Delphi technique. In this section of the literature review the Delphi technique will be examined. Specific areas of examination are: (1) the definitions of the technique, (2) the history, purposes, and philosophy of the technique, (3) the process of the technique, (4) disadvantages, limitations and problems of using the technique, and (5) advantages and applications of using the technique.

Definition

According to Linstone and Turoff (1975) it is difficult to find one definition of the Delphi technique because it has been applied in such varying situations. However, below are several definitions that have been developed by experts using and writing about the technique.

> Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem.... To accomplish this structured communication there is provided: some feedback of individual contributions of information and knowledge; some assessment of the group judgment or view; some opportunity for individuals to revise views; and some degree of anonymity for individual responses (Linstone & Turoff, 1975, p. 3).

> Delphi is a group process which utilizes written responses as opposed to bringing individuals together. ... it is a means for aggregating the judgments of a number of individuals in order to improve the quality of decision making....Delphi is essentially a series of questionnaires (Delbecq & Gustafson, 1975, p. 83).

> The Delphi Technique ... replaces direct debate by a carefully designed program of sequential individual interrogations (best conducted by questionnaire) interspersed with information and opinion feedback derived by computed consensus from the earlier parts of the program (Helmer, 1966, p. 17).

> Delphi ... operates on the principle that several heads are better than one in making subjective conjectures ... and that experts ... will make conjectures based upon rational judgment and shared information rather than merely guessing, and will separate their own hopes and personal motivation from considered judgment in the process (Weaver, 1972, p. 6).

> Delphi is a survey approach that pools judgments without discussion. The term is somewhat whimsically drawn from the mythological Greek oracle of Delphi. A delphi survey systematically solicits and collates judgments to form a synthetic group. A series of questionnaires is used (Nutt, 1984, p. 106).

From these definitions some common elements of a Delphi can be extrapolated. They are: (1) it is a group process, (2) it is a communication process, (3) there is a feedback loop, (4) there is usually some degree of anonymity for individual members, and (5) it is a decision making process.

History, Purposes and Philosophy

The first use of the Delphi technique was in "Project Delphi" which was an Air Force sponsored Rand Corporation study beginning in the early 1950's using expert opinion. The objective of this study was to achieve consensus by experts using questionnaires with controlled opinion feedback. However, work in 1964 by T.J. Gordon and Olaf Helmer brought the Delphi technique from the defense community to the notice of the outside community. The Gordon and Helmer study was a Rand Report on long range trends mainly in the areas of science and technology (Linstone & Turoff, 1975). Since 1964 the uses for the Delphi technique have increased. The Delphi has been used in a variety of situations for a variety of purposes (Delbecq & Gustafson, 1975; Linstone & Turoff, 1975). For example, Sweigert and Schabacker (1974) used the Delphi technique to help to establish consensus about educational goals, the Michigan

Developmental Disabilities Council (1989) used the Delphi technique to help to establish consensus on the quality of family support of families with handicappers, Operach (1988) used the Delphi technique to build alternative speech and language models for elementary children, and Helmer (1966) used the Delphi technique for a long-range forecasting study.

Some of the purposes of a Delphi study outlined by Weatherman and Swenson (1974) are: (1) a forecasting probe, (2) a strategy probe, and (3) a preference probe. Linstone and Turoff (1975) describe some of the Delphi technique applications. They are:

> Gathering current and historical data not accurately known or available,
>
> Examining the significance of historical events,
>
> Evaluating possible budget allocations,
>
> Exploring urban and regional planning options,
>
> Planning university campus and curriculum development,
>
> Putting together the structure of a model,
>
> Delineating the pros and cons associated with potential policy options,
>
> Developing causal relationships in complex economic or social phenomena,
>
> Distinguishing and clarifying real and perceived human motivations, and
>
> Exposing priorities of personal values, social goals (p. 4).

Linstone and Turoff (1975) and Mitroff and Turoff (1975) investigated the Delphi technique in relationship to five philosophical theories. Since one of the philosophical theories does not relate directly to the Delphi technique, this researcher will examine four of the theories. According to Mitroff and Turoff, (1975) the characteristics of the Lockean Inquiring System philosophy are:

> Truth is experiential, ie., the truth content of a system (or communication) is associated entirely with its empirical content. A model of a system is an empirical model and the truth of the model is measured in terms of our ability (a) to reduce every complex proposition down to its simple empirical referents (i.e., simple observations) and (b) to ensure the validity of each of the simple referents by means of the widespread, freely obtained agreement between different human observers....In sum, the data input sector is not only prior to the formal model or theory sector but it is separate from it as well. The whole Lockean IS (inquiring systems) is built up from the data input sector (p. 21).

The Lockean model relates to the Delphi technique when the researcher gathers data from the participants based on their experiences and then tries to achieve consensus from the participants. The Helmer (1966) forecasting studies done for the Rand Corporation using the Delphi technique are examples of using the Lockean model. This has been the most common model for using the Delphi technique.

According to Mitroff and Turoff, (1975) the characteristics of the Kantian Inquiring System philosophy are:

> Truth is synthetic, i.e., the truth content of a system is not located in either its theoretical or its empirical components, but in both. A model of a system is a synthetic model in the sense that the truth of the model is measured in terms of the model's ability (a) to associate every theoretical term of the model with some empirical referent and (b) to show that (how) underlying the collection of every empirical observation related to the phenomenon under investigation there is an associated theoretical referent...Theory and data are inseparable....Kantian IS are the epitome of multimodel, synthetic systems. On any problem, they will build at least two alternate representations or models of it (p.

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27-27).

The Kantian model relates to the Delphi technique when the researcher uses alternate scientific theories and gathers data integrated from several disciplines and from these components builds more than one model or alternative. An example of a Delphi study that used the Kantian model is the Adelson and Aroni study (Linstone & Turoff, 1975) of "Differential Images of the Future." This is not a very common philosophical base for the researchers using the Delphi technique.

Hegelian, or Dialectical Inquiring Systems, according to Mitroff and Turoff (1975) have these characteristics:

> Truth is conflictual; i.e., the truth content of a system is the result of a highly complicated process which depends on the existence of a plan and diametrically opposed counterplan. The plan and the counterplan represent strongly divergent and opposing conceptions of the whole system. The function of the plan and counterplan is to engage each other in an unremitting debate over the true nature of the whole system, in order to draw forth a new plan that will, one hopes, reconcile (synthesize, encompass) the plan and the counterplan....The data input sector is totally meaningless and only becomes meaningful, i.e., 'information', by being coupled to the plan and counterplan....Finally, it is also assumed that on every issue of importance, there can be found or constructed a plan and a counterplan; i.e., a dialectical debate can be formulated with respect to any issue (p. 29-30).

Debate and conflict with reconciliation as the end product, hopefully, would be indicators of a Delphi study run using the Hegelian philosophical underpinnings. This researcher found only one Delphi study using this philosophical base which was a policy Delphi by Turoff (1975).

Singerian-Churchmanian Inquiring Systems, according to

Mitroff and Turoff (1975) have these main features:

> Truth is pragmatic: i.e., the truth content of a system is relative to the overall goals and objectives of the inquiry. A model of a system is teleological, or explicitly goal-oriented, in the sense that the 'truth' of the model is measured with respect to its ability to define (articulate) certain systems objectives, to propose (create) several alternate means for securing these objective, and finally, at the end of the inquiry, to specify new goals (discovered only as a result of the inquiry) that remain to be accomplished by some future inquiry. Singerian inquiry is thus in a very fundamental sense nonterminating though it is response oriented at any particular point in time; i.e., Singerian inquirers never give final answers to any question although at any point they seek to give a highly refined and specific response....The system forms an inseparable whole....The designer's psychology and sociology are inseparable from the system's physical representation (p. 33).

Large studies that are ongoing and changing dealing with holistic concerns and including the designer or designers of the study as part of the study would be indicators of this type of Delphi study using the Singerian-Churchmanian Inquiring System. Using a computer search, this researcher found no Delphi studies that have used this philosophical base. However, the potential to use it with the Delphi technique exists, if cost and time limitation could be addressed. The issues that might be addressed using a Delphi study that incorporates this philosophical might be holistic issues (i.e. environmental concerns) with strong ethical considerations.

In summary, in the early 1950's the Delphi technique was developed by the Rand Corporation using a grant from the Air Force. However, the work of T. J. Gordon and Olaf Helmer brought the Delphi technique to the notice of a more general audie

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audience. The Delphi technique has been used for a variety of purposes and applications. Finally, the Delphi technique, according to purpose and application can have a variety of philosophical underpinnings. Four of these philosophical underpinnings (Lockean, Kantian, Hegelian, Singerian), as they related to the Delphi technique were examined.

The Process of the Delphi Technique

Several authors have outlined the process of the Delphi Technique (Helmer, 1966; Nutt, 1984; Weaver, 1972; Linstone & Turoff, 1975; Delbecq & Gustafson, 1975; Sweigert & Schabacker, 1974; Hopkins, 1972, and Moore, 1987). Delbecq and Gustafson (1975) developed a 10 step process plan for implementing the Delphi technique. The 10 steps are: (1) develop the Delphi question, (2) select and contact the respondents, (3) select the sample size, (4) develop the Questionnaire #1 and the test, (5) do the analysis of Questionnaire #1, (6) develop Questionnaire #2 and test, (7) do the analysis of Questionnaire #2, (8) develop Questionnaire #3 and test, (9) do the analysis of Questionnaire #3, and (10) prepare a final report. Although these are fairly common procedures for doing a Delphi study, modifications do exist. For example, the number of rounds or questionnaires may vary from 2 to 4 (Helmer, 1965; Delbecq & Gustafson 1975), and the way data is collected can range from using the telephone (Linstone & Turoff, 1975) to using cassette tapes (Delbecq and Gustafson, 1975). The Delphi techn

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technique has also been used in "real time" studies during computer conferences or meetings (Moore, 1987). In the preceding paragraphs some of the elements of the process of the Delphi technique are discussed.

Selection of the Panel of Experts

Helmer (1975) outlines his reasons for using and relying on expert opinion to arrive at predictions and decisions.

> Reliance on the intuitive judgment of experts is thus not just a temporary expedient but a necessary ingredient of futures research, for such experts are needed in all phases of the effort. They are called upon (1) to supply judgmental data about the future, based on their intuitive, though often theoretically unstructured, insights into real-world phenomena; (2) to construct ad hoc models or to judge the suitability of existing models; (3) to apply their expertise as role players in simulation games, and (4) to use their imagination and inventiveness to design the instrumentalities and long-range strategies that result in appropriate action programmes for dealing with the problems of the future (p. 6).

As criteria for the selection of experts for the panel, Helmer (1966) gives knowledge about the subject area, and reliability that is determined by how accurate their predictions have been in the past. Nutt (1984) adds the criterion of motivation as important in the selection process of experts. Weatherman and Swenson (1974) add the criteria of representativeness of the panel and independence of responses.

Helmer (1966) divides experts into 2 groups which are the specialists and the generalists. The specialists can provide information or predictions. The generalists can provide problem-formulation, model-structuring, or prefe

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preference-evaluation among alternatives. According to Helmer, experts' performance can be improved significantly by grouping them with other experts in their field and allowing them to interact anonymously.

Sample size varies from study to study. Delbecq and Gustafson (1975) states that in a homogeneous group of experts 10 to 15 participants might be enough. Whereas, in a study where there are various groups, the researcher might need several hundred people. It is their contention, however, that a well chosen group of 30 usually is sufficient to generate the data needed. Nutt (1984) believes that 10 to 15 is a manageable panel size. Weatherman and Swenson (1974) reported that most panels are made up of less than 50 members, but report that the Cyphert and Gant Study had 400 participants.

In summary, Delphi studies rely on experts on the panel. These experts can be specialists or generalists. Important criteria in the selection of the panel members are: (1) they are knowledgeable about the subject area, (2) they are motivated to participate in the study, (3) they are representative of the expert population in their area of expertise, and (4) their responses are independent of one another. Sample size varies with the study being conducted. The most common sample size is under 50 with 30 being average.

Format of the Initial Round

The Helmer study (1964) using the Delphi technique used questions and a questionnaire. Weatherman and Swenson (1974) recommend open-ended questions for the initial round. Moore 1987) details Delphi studies using questions and a questionnaire for which questions are derived from a literature search. Delbecq and Gustafson (1975) suggest that in the initial round, respondents should be asked to respond to a broad question. According to Weaver (1970), respondents in the initial round should be asked to generate several specific statements of events. Although several techniques are possible in the initial round, a questionnaire consisting of several questions or a single question is the most common way to start a Delphi study.

Number of Rounds

In the Helmer (1964) study and the Operach (1988) study using the Delphi technique, there were 4 rounds. Nutt (1984) recommends 5 rounds as minimal to achieve results. However, for a simple form of a Delphi study, one that only requires pro and con analysis, 3 rounds are minimal. Uhl (1975) claims convergence to consensus after 2 or more rounds. Moore (1987) describes conditions where the rounds would vary from 3 to 5 rounds. Sweigert and Schabacker (1974) contend that it takes 3 or more rounds to produce reliable, convergent results. Weatherman and Swenson (1974) and Delbecq and Gustafson (1975) suggest 3 rounds. Young (1977) states, using the results of a computer search, that the majority of Delphi studies use 3 rounds.

Disadvantages, Limitations and Problems of Using the Delphi Technique

One of the major disadvantages to using the Delphi technique is the time it takes (Moore, 1987). The minimum amount of time to allow for a Delphi study according to Delbecq and Gustafson (1975) is 44.5 days. Moore (1987) and Linstone & Turoff (1975) also state that another disadvantage or problem of using the Delphi technique could be the bias and honesty of the monitoring team.

The lack of face to face communication is of concern to Moore (1987). Linstone and Turoff (1975) also believe the process can limit communication.

> While the written word allows for emotional content, the Delphi process does tend to minimize the feelings and information normally communicated in such manners as the tone of a voice, the gesture of a hand, or the look of an eye. In many instances these are a vital and highly informative part of a communication process (p. 7).

Delbecq and Gustafson (1975) state that the Delphi process can cause "a feeling of detachment from the problem-solving effort [and cause] ...communication and interpretation difficulties among respondents"(p. 35).

Uhl (1975) had concerns about how permanent convergence to consensus was because of a study he ran a year after he had conducted a study where there was convergence to consensus. In the second study he ran, his conclusion was that the changes in opinion were only temporary. Weatherman and Swenson (1974) had concerns about distortions in results due to the selection of participants, and that the studies that tested the assumptions of the technique have produced ambiguous results.

Weaver (1970) states:

> It is therefore crucial that these tools heavily emphasize the explanations upon which the plausibility of the forecast rests. An intuitive forecast which carries with it no explanatory quality may be correct, but it would be trivial. That is the singular weakness of Delphi (p. 269).

Delbecq and Gustafson (1975) believe one of the disadvantages to using the Delphi technique is the high motivation it requires of the respondents. The technique is greatly influenced by the commitment and interest of the participants.

Linstone and Turoff (1975) list these reasons a Delphi might fail:

> Imposing monitor views and preconceptions of a problem upon the respondent group by overspecifying the structure of the Delphi and not allowing for the contribution of other perspectives related to the problem.
>
> Assuming the Delphi can be surrogate for all other human communications in a given situation.
>
> Poor techniques of summarizing and presenting the group response and ensuring common interpretations of the evaluation scales utilized in the exercise.
>
> Ignoring and not exploring disagreements, so that discouraged dissenters drop out and an artificial consensus is generated.
>
> Underestimating the demanding nature of a Delphi and the fact that the respondents should be recognized as consultants and properly compensated for their time if the Delphi is not an integral part of their job function (p. 6).

To summarize there are some disadvantages, limitations, and problems in using the Delphi technique. Many of these are due to the way Delphi has been used rather than to inherent weaknesses in the Delphi technique. However, further research needs to be done to determine how to strengthen the process.

Advantages and Applications of Using the Delphi Technique

Helmer (1966) details several advantages to using the Delphi technique. They are:

1. Expert opinion is a necessity when a choice needs to be made among alternative solutions when there is no accepted body of knowledge about what is the one best course of action.
2. The technique reduces the tendency for some experts to be influenced by the bandwagon effect of majority opinion or a particularly persuasive person.
3. Feedback by a peer group can stimulate the experts to take into consideration elements that they may not have thought about before or thought were unimportant.

Linstone and Turoff (1975) lists these reasons to use the Delphi technique.

> The problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis,
>
> The individuals needed to contribute to the examination of a broad or complex problem have no history of adequate communication and may represent diverse backgrounds with respect to experience or expertise,
>
> More individuals are needed than can effectively

interact in a face-to-face exchange,

Time and cost make frequent group meeting infeasible,

The efficiency of face-to-face meetings can be increased by a supplemental group communication process,

Disagreements among individuals are so severe or politically unpalatable that the communication process must be refereed and/or anonymity assured, and

The heterogeneity of the participants must be preserved to assure validity of the results, i.e., avoidance of domination by quantity or by strength of personality (bandwagon effect) (p. 4).

Weatherman and Swenson (1974) detail the advantages for using the Delphi technique. They are: (1) anonymity is valuable, (2) it provides a means of obtaining information about complex issues, (3) it helps experts to conceptualize complex issues, (4) it is a simplifying device, and (5) it is efficient because it focuses attention on the topic and allows control by the survey manager.

Weaver (1972) concludes..."that Delphi, in combination with other tools, is a very potent device for teaching people to think about the future in much more complex ways than they ordinarily would" (p. ii). He also gives some suggestions that he believes will correct some of the disadvantages of using the Delphi technique. They include: (1) Participants making sure they are familiar with the topic under consideration, (2) The use of category width rather than specific dates or pro and con, (3) Direct confrontation of participants, (4) Participants should be asked to explain their answers and choices, (5) Participants should be given at least 2 sets of factors that might influence their topic,

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(6) Participants should weigh the desirability of an outcome,
(7) Feedback should be open discussion in small groups, and
(8) Convergence should be taken as an indicator of force of an argument, not how accurate an outcome is (p. 48-49).

Although some of these suggestions would be controversial to other experts of the Delphi technique, they do provide a forum for discussion.

In summary, there are many advantages to using the Delphi technique. These advantages have been recognized by the experts in the field as well as researchers in other fields. A computer search of Eric for the years 1966 through 1991 run by this researcher showed that there are 631 listings that have Delphi as one of the descriptors. It is clear that the Delphi technique is a popular research technique because of some of the advantages of using it.

ELEMENTS OF COGNITIVE/LEARNING STYLE AND THE INVENTORIES THAT MEASURE COGNITIVE/LEARNING STYLE

In this section the definitions of cognitive/learning are examined. Additionally, the literature about the applications of cognitive/learning style and the value of teaching to learners' cognitive/learning style are explored. Finally, assessment inventories of cognitive/learning style are investigated.

Definitions of Cognitive/Learning Style

Several definitions have been used for cognitive/learning style. Some experts in the field have even given separate definitions for cognitive style and learning style.

Hill (1981) defines cognitive style as, "the general mode of activity, method, or approach employed by an individual in the process of conceptualization, i.e. in the process of forming shared or relatively well-agreed upon interpretations of a set of sensations" (p. 63). He defines learning style as "the mode of activity, method, or approach employed by an individual in both the process of perceptualization, i.e., in the process of form an individual interpretation of a set of sensations, and in the process of conceptualization" (p. 63-4).

Rita Dunn (1981) also gives separate definitions for learning and cognitive style.

> Learning style is the way in which individuals respond to the environmental, emotional, sociological, and physical stimuli that surround them: whereas cognitive style-whether it refers to field dependence or independence, global or analytic approaches the 'brain' concept of learning, or specific study skills-describes the ways in which the brain processes information (p. 34).

Zanden and Pace (1980) define style which they label cognitive style in this way.

> In its broadest sense, cognitive style may be thought of as an individual's typical mode of processing information. It refers to consistencies in an individual's way of functioning in his or her day-to-day activities, especially when the activities have to do

with organizing and categorizing perceptions (p. 114).

Curry (1987) feels that the terms learning style and cognitive style should not be used because they are overused and regularly confused. He proposes, instead, a series of new terms to replace learning style and cognitive style. The terms are: (1) Cognitive personality style, (2) Information processing style, (3)Instructional preference, and (4) Learning strategy.

Blakemore, McCray, and Coker (1984) acknowledge the variety of definitions given by researcher, 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 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 (p. 1).

Cornett (1983) feels that educators are often confused by the labels and categories used to describe and define style. She uses the term learning style as a general term to define learning and cognitive style.

> Essentially, learning style can be defined as a consistent pattern of behavior but with a certain range of individual variability. When persons learn they use learning styles that are uniquely their own, but make moment-by-moment style adjustments, depending on the nature of the task and the teaching style being used. Styles then are overall patterns that give general direction to learning behavior (p. 9).

Finally, the definition that is used in this study because it is a broad definition including both cognitive style and learning style, is the definition developed by Keefe and Languis adopted by the NASSP Task Force and reiterated by Keefe and Monk (1987) in their Learning Style Profile Examiner's Manual.

> The composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment. It is demonstrated in that pattern of behavior and performance by which an individual approaches educational experiences. Its basis lies in the structure of neural organization and personality which both molds and is molded by human development and the learning experiences of home, school, and society (p. 1).

In summary, there are many definitions of style. Some definitions only define cognitive style, others define learning style, others define both. A broad definition of style is the Keefe and Languis definition adopted by the NASSP Task Force and, it is the definition used in this research.

Cognitive/Learning Style

The development of theory and instruments to measure cognitive/learning style has been in response to educators asking what makes instruction successful. There is ample research which seems to prove the cognitive/learning style of students does affect instruction. As examples: reading achievement and cognitive/learning style has been researched thoroughly. It has been found that children learn to read better when they are taught through their style (Carbo, 1983), style is a predictor of reading comprehension (Smith, 1981), cognitive/learning style affects reading skills (Readence, 1977), and cognitive/learning style is a better

predictor of reading achievement than I.Q. (Kaley, 1977). There has been some research that indicates cognitive/learning style and affective learning outcomes are related. When teaching style and cognitive/learning style were matched affective or behavioral outcomes were influenced (Cotterell, 1982), style correlated with course satisfaction (Drummond & McIntire, 1977), and student's style and self-concept are correlated (Griggs & Price, 1981). Cognitive/learning style is also a predictor of academic achievement (Cohen, 1968; Letteri, 1980; Yeats & Strag, 1971), and an understanding of a particular style should help teachers to evaluate individual performances on classroom standardized tests (Coop & Sigel, 1971).

There is research to show that cognitive/learning style varies among different groups. For example, the style of Nigerian and American children differ (Hale, 1981), style differs between gifted and nongifted students (Stewart, 1981), the style between learning disabled and nondisabled differ (Sigg & Gorgirilo, 1980; Guyer & Friedman, 1975) and economically disadvantaged students have common elements on an cognitive/learning style profile (Hallahan, 1970). Research has also shown thinking patterns and style have a relationship such as concept identification (Davis & Klausmeier, 1970) and formal patterns of reasoning (Lawson & Wollman, 1977). Students' choices in academic programs often matches their style (Witkin et al., 1977). Research shows that teachers who know and adapt to a student's style do a

more effective job of teaching in terms of learning outcomes (Mullally, 1977; Dunn & Dunn, 1981).

Witkin (1977) in a summary article about cognitive/learning style makes these points that are backed up by the research.

1. A person is consistent in style across different tasks.

2. Learners are very stable in a preferred mode of style over a very long time.

3. There is a difference in style between men and women.

4. Differences in style appear in problem solving.

5. Style affects perceptual and intellectual activities.

6. How people respond in social situations is affected by their style.

7. How well people can express feelings and attitudes is determined by style.

8. Whether people like to be with people or not is affected by style.

9. Style affects a person's body language.

10. How well people are liked is affected by their style.

11. What jobs people select is affected by their style.

12. The amount and kind of reinforcement needed to learn is affected by style.

13. How well criticism is tolerated is affected by style.

14. The degree of structure that a teacher needs to offer in order for students to learn is affected by style.

15. Teacher and student match or mismatch in style cause a difference in student satisfaction in a course.

16. Career choices are affected by style.

17. Style and performance in specialized areas are related.

Problems and Issues Addressed in the Literature Concerning Cognitive/Learning Styles

A number of problems and issues have been addressed in the literature concerning cognitive/learning style. In the area of the theoretical base and the construct of cognitive/learning style some questions have been posed. Denson (1977) believed that researchers needed to build some theory to undergird the area of cognitive/learning style. McNary, Michael, Richards and Lovell (1975) in a study of 100 fifth and sixth grade students concluded that there was no universal construct of cognitive style. Curry (1987) stated that there was no unitary concept of cognitive/learning style. Resulting from the lack of a unitary theoretical base is the issue of the multitude of definitions of cognitive/learning style and the definitions of the terminology used to describe cognitive/learning style (Curry, 1987; Denson, 1977). The field of cognitive/learning style is often described in the literature as fragmented (Curry, 1987).

How stable is an individual's cognitive/learning style is another issue addressed in the literature. Coop and Sigel (1971) and Davis (1971) found that cognitive/learning style among young children was fairly stable, but by the time students reached college age cognitive/learning style was not very stable. However, Witkin (1977), Keefe (1977), and Dunn, DeBello, Brennan, Krimsky, and Murrain (1981) disagree and offered evidence that cognitive/learning style is relatively stable for each individual learner.

Matching a learner's cognitive/learning style with his or her learning environment should bring about better learning according to several developers of inventories (Dunn et al., 1981; Keefe, 1977; Gregorc, 1977). However, Coop and Brown (1970) in a study of 80 college students concluded,

> ...there is no significant interaction between cognitive style and teaching method in regard to either factual content achievement or conceptual-generalization content achievement. This finding may have resulted, in part, from the inability of the experimenter to design teaching methods which were specifically analytic or specifically nonanalytic ...(p. 404)

Davidman (1981) objected to trying to match learners' styles with instruction. He contended that mismatching styles and instruction makes students learn to use several types of cognitive/learning styles and makes them better learners.

Cognitive/Learning Style Assessment Inventories

Research in education and the behavioral sciences is extremely complex and fairly recent. Education did not begin to emerge as a science until the start of the twentieth century.

> Scientific progress is based to a large degree upon the precision of our instruments and upon our ability to measure the phenomena concerned with the science in question. A student who examines the history of any sciences will find that development of better tools is almost invariably followed by important gains in scientific knowledge, disproof of some theories, and confirmation of others. The relatively late emergence of education, psychology, sociology, and other behavioral sciences is due largely to the complexity of the phenomena they attempt to measure and the consequent

> slow progress in developing measuring tools (Borg & Gall, 1979, p. 1-2).

Research into cognitive/learning style and the assessment inventories that measure style is further complicated by the fact that both psychologists and educators, at different times, have studied cognitive/learning style and have come up with two separate or parallel lines of research (Keefe, 1982). Also there seems to be no integrated theory of learning (Thompson [NASSP] 1982) or a theoretical framework for cognitive/learning styles. According to Keefe, (1988) "diagnosis is the most neglected function of schooling. Diagnosis includes the assessment of student developmental characteristics, acquired knowledge and skills, and cognitive/learning style. Learning style is probably the least understood element of diagnosis" (p. 2). Besides, learning style research has been hindered by the lack of available instruments or inventories to measure the full range of educational styles (Ferrell [Keefe Ed.], 1988). Another complicating factor that adds to the lack of clarity to the field is the feeling that there should be one solution to magically solve all learning problems. For example, from this viewpoint came the idea that individualized instruction would solve all learning problems. As with all "one pronged" approaches to learning, some students benefited and some students failed (NASSP, 1979). The panacea approach, whether it be for educational styles or individualized learning, can only cause suspicion of the whole topic (Gregorc, 1982). Guilford (1980) sums up what needs to be done in the field of educational style by commenting that research needs to be done to determine connections, definitions, to develop models and to clarify the field.

An ERIC (Educational Resources In Education) search done in February, 1988 revealed 2,714 documents in ERIC under cognitive style which is the descriptor that is used in ERIC for learning/cognitive style. ERIC only lists documents written from 1966. Presently it indexes government-funded research grants, state publications, curriculum guides, papers presented at professional meetings, educational pamphlets and, since 1969, journals in education. It does not generally index dissertations and books. An ERIC computer search that matched comparison, contrast and analysis with learning and cognitive styles with inventory(s) test measurement and instrument(s) showed there were only 6 documents that were indexed under these terms. Of these 6, only 2 compared, contrasted, and evaluated different types of cognitive/learning styles inventories..

The first of these 2 articles was written by Helen S. Lepke in the Foreign Language Annuals (1978). It is titled "Assessing Individual Learning Styles: An Analysis of Five Instruments". It was mainly a descriptive study of five learning style instruments. They were: Harry Reinert's ELSIE; Joseph Hill's Cognitive Style Interest Inventory; Anthony Papalia's Learning Modalities and Individual

Difference Inventories; David Hunt's Paragraph Completion Method; and the Dunn, Dunn, and Price Learning Style Inventory. Ms. Lepke briefly described each inventory but offered very little comparison and/or contrast among the 5 instruments. Because this was mainly a descriptive study there was very little analysis of the different inventories. This study contained no standardized criteria to evaluate the different inventories.

The second article was written by Barbara G. Ferrell (1983). Its title was, "A Factor Analytic Comparison of Four Learning-Styles Instruments," and was published in the Journal of Educational Psychology. Ms. Ferrell looked at 4 inventories. These inventories were: Grasha and Riechman's Student Learning Style Scales; Johnson's Decision Making Inventory; Kolb's Learning Styles Inventory; and Dunn, Dunn and Price's Learning Style Inventory. The author's primary objective in this article was to determine if these 4 instruments had construct validity and a theoretical base. Using a theoretical conceptualization developed by J.W. Keefe, Ms. Ferrell did a factor analysis of all 4 learning styles inventories and found they measured different constructs. Keefe (1983) conceptualized learning style (cognitive/learning style) as composed of 3 types of behaviors: cognitive, affective and physiological/physical.

> A cognitive behavior was viewed as one resulting from a preference for a given type of information processing or cognitive style. An affective behavior was the result of a given attitude or opinion. Physical/physiological learning style behaviors are of two types:

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> environmental factors that impinge on learning and biological factors in the makeup of individual that have an impact on the learning situation (p. 33).

This article gave a brief description of each inventory and compared, contrasted and analyzed the 4 inventories only as they related to Keefe's conceptualization. A model was built that measured the cognitive, affective and physical/physiological characteristics from the Keefe conceptualization of learning styles. Because of the narrow scope of this research and the complex mathematical procedures the value to practitioners is somewhat limited.

As a result of this computer search this researcher was able to find that there were 64 published assessment inventories of cognitive/learning style. Of the 64 inventories, 26 had been written about in several professional journals and magazines.

Another ERIC search in March, 1989 matched combinations of 3 terms: test construction, cognitive style and models. Only 3 documents were found and none of them directly related to the research proposed here. In addition, the term evaluation methods was also matched with cognitive style. For this match 3 documents were found, but none were directly related to this research. In turn, the descriptor cognitive style was matched with combinations of measures, individual educational and diagnosis testing. There were 21 documents found using this match but none of them were directly related to this research. Lastly, the terms test construction and evaluation methods were matched with test-validity and test-

reliability. There were 26 documents found, and two of the documents were relevant to this research.

The first document that related directly to this research was a research report titled A Guide To Learning Style Assessment by Thomas Blakemore, Paul McCray and Charles Coker (1984). This report described 12 learning style assessment instruments. They were:

1. Learning Style Inventory and the Productivity Environmental Preference Survey, by Dunn et al.
2. Learning Styles Inventory, by Renzulli & Smith
3. Your Style of Learning and Thinking, by Torrance et al.
4. Learning Styles Inventory, by Canfield & Lafferty
5. C.I.T.E. Learning Style Inventory, by Canfield & Lafferty
6. Learning Interaction Inventory, by Jacobs & Fuhrmann
7. Grasha-Reichmann Learning Style Inventory
8. The Learning Style Inventory, by Hanson & Silver
9. Learning Style Inventory, by Kolb
10. Cognitive Style Mapping, by Hill
11. Assessing Conceptual Level (with paragraph completion method), by Hunt, and
12. 4-MAT System by Bernice McCarthy

In this report, the 12 inventories were compared and contrasted by using a model that looked at five factors. The factors were cognitive, social, motivational, physical and instructional. The 12 assessment instruments were chosen because they could be used by rehabilitation professionals.

The 5 factors in the model were selected because the authors felt they described the content in the 12 assessment instruments. Although a model was constructed from this research it was developed for a limited audience. The model developed for this dissertation will be for a broader more general audience of users.

The second related document was a paper titled Three Measures of Cognitive Style: Characteristics, Factor Structure, and Implications for Researchers. by Teri A. Denson (1977). In this paper 3 assessment inventories of cognitive style were compared and contrasted. The inventories were:

1. Group Embedded Figures Test, by Witkin et al.
2. The Nowicki Strickland Locus of Control Scale, by Nowicki and Strickland, and
3. Sutton-Smith and Rosenberg Impulsivity Scale, by Sutton-Smith & Rosenberg.

The inventories were compared and contrasted on distribution characteristics, psychometric properties and an underlying factor structure. Although differences were described, no visual model was developed to compare and contrast the inventories. Additionally, the author did not suggest that the process she had developed could be transferred to other inventories.

A manual search of Current Index To Journals Of Education, an index that overlaps the materials in ERIC but includes earlier journals, did not reveal any additional information.

A computer search of Psychological Abstracts done in February of 1988 revealed 3,034 documents with the descriptor cognitive-style. However, a match with the terms inventory, tests, measurement, instrument with comparison, contrast, analysis only yielded 10 documents. Out of the 10 documents, there were none that compared or contrasted or analyzed 2 or more cognitive styles. A March 1989 search that matched the terms test-construction with test-validity, and test reliability with evaluation found 10 documents. None of the 10 documents directly related to this research. Psychological Abstracts indexes journals and serial publications about psychology and related disciplines world wide. The computer indexes of Psychological Abstracts cover 1967 to present.

Dissertation Abstracts International indexes doctoral dissertation abstracts submitted to University Microforms International. There are 430 cooperating institutions in the U.S. and Canada. The computer search run by this researcher covered from 1861 to March 1988. Abstracts are subject indexed by the key words in the title. When the computer searched for the key words of cognitive style(s), it found 1,274 documents. However, when cognitive style(s) was matched with inventory, inventories, test, measurement, instrument with comparison, contrast and/or analysis only 6 documents were found. Of the 6 documents, only 1 was relevant to this research. It was "A Factor Analytic

Comparison of Four Learning-styles Instruments" which has already been discussed.

An updated computer search and expert review in 1990 revealed 2 more documents that were relevant to this study. The first is written by Lynn Curry (1987), titled, Integrating Concepts of Cognitive or Learning Style: A Review with Attention to Psychometric Standards. In this document Curry investigates 22 assessment inventories of cognitive/learning style in relationship to an "onion" organizational model. He also looks at the reliability and validity of all of the inventories. The way he evaluates the strength of the validity and reliability of each instrument is by reviewing well designed studies and counting the number of acceptable results across several measures of validity and reliability. The inventories that he reviews and evaluates are:

1. Biggs-Study Process Questionnaire,
2. Canfield-Learning Styles Inventory,
3. Dunn, Dunn & Price-Learning Style Inventory,
4. Entwistle and Ramsden-Approaches to Studying,
5. Friedman & Stritter-Instructional Preference Questionnaire,
6. Goldberg-Oregon Instructional Preference Inventory,
7. Grasha-Riechmann-Students Learning Style Scale,
8. Hill-Cognitive Style Interest Inventory,
9. Hunt et al. Paragraph Completion Method,
10. Kagan-Matching Familiar Figures Test,

11. Kempa & Dube-Cognitive Preference Test,
12. Kolb-Learning Style Inventory,
13. Myer-Briggs Type Indicator,
14. Papalia-Learning Modalities Inventory,
15. Reinert Edmonds Learning Style Identification Exercise,
16. Renzulli & Smith-Learning Styles Inventory,
17. Rezler & Rezmovic-Learning Preference Inventory,
18. Schmeck et al.-Inventory of Learning Processes,
19. Schroder-Paragraph Completion Test,
20. Tamir et al.-Cognitive Preference Inventory,
21. Witkin-Embedded Figures Test, and
22. Witkin-Group Embedded Figures Test.

This is the largest study done that has been found by this researcher. It also gives the greatest details about individual inventories in relationship to content, format, psychometric properties, and even places to order the inventories. The problems with this research are that several of the tests reviewed are not commonly used tests, and the information presented, although valuable, is not easily converted for use by the average practitioner.

The second document is by Thomas C. De Bello (1988), and titled, Comparison of Eleven Major Learning Styles Models: Variables; Appropriate Populations; Validity of Instrumentation; and the Research Behind Them. He looks at 11 inventories. They are:

1. Dunn, Dunn, & Price-Learning Style Inventory,
2. Keefe-NASSP Learning Style Profile,

3. Hill-Cognitive Style Profile,
4. Letteri-Cognitive Style Delineators,
5. Ramirez-Child Rating Form,
6. Reinert-Edmonds Learning Style Identification Exercise,
7. Schmeck-Inventory of Learning Processes,
8. Hunt-Paragraph Completion Method,
9. Kolb-Learning Style Inventory,
10. Gregorc-Gregorc Style Delineator,
11. McCarthy-4 MAT System.

This study, although it details the 11 inventories, is somewhat limited in scope because it only reviews 11 inventories.

Summary

A review of the literature seems to show:

1. Cognitive/learning style is an important measurable element in learning.
2. Research on cognitive/learning style is fragmented and scattered so that it is difficult to evaluate the inventories that measure style.
3. There has been limited research on evaluation of the different cognitive/learning style inventories.
4. Models that have been developed that might help practitioners to decide which inventory to use are very limited in scope and/or audience that they address.

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CHAPTER 3

DESIGN OF THE STUDY

Outline of Research Design

The purpose of this study was to develop a model for evaluating and choosing among widely used assessment inventories of cognitive/learning style. The Delphi research method was used to query experts in the field of cognitive/learning style assessment inventories, to obtain consensus from the experts, and to construct a model from the consensus. The model was built as an aid for practitioners in the selection of an appropriate assessment inventory to meet a specific educational need.

The Delphi Method was used as the research methodology. Three instruments in separate rounds were sent to each of the 41 participants in the study. Participants were chosen by reading the literature on cognitive/learning style assessment inventories and making a list of people who had written on or presented materials about cognitive/learning style assessment inventories. Addresses and phone numbers of the initial list of 142 experts were obtained by using the literature and directories listing colleges and universities and professors. Also phone directories were used. Of the 142 experts, this researcher was able to contact 60 experts by telephone from the initial list. From the list of 60 experts, 41 agreed to participate in the study. The questions for Round One (see

Appendix A) were sent to the 41 participants on February 26, 1990. The questions for Round 2 (see Appendix B) were sent to the 41 participants on April 9, and the questions for Round 3 (see Appendix C) were sent to the 41 participants on September 2. Postcards were sent to participants who had not responded by the deadline date to remind them to return the surveys. The first round of the Delphi presented a series of broad questions and each subsequent round built on the responses from the previous rounds. The object was to achieve consensus among the experts. Although the experts were selected randomly, the population was not. Participants were chosen because they were the best informed concerning the subject of this study. Random sampling would have been inappropriate for the purposes of this study. "This (was) a purposive sample, rather than a representative one that would provide a statistical basis for generalization to a larger population..." (Willis & Bartell, 1988, p. 20-1).

Results from the three Delphi Rounds assisted the researcher to respond to the following research questions.

Research Questions

Primary Research Question

What process can practitioners follow reliably to select a cognitive/learning style assessment inventory that effectively match their needs?

This question was posed because there is a need to choose between numerous inventories in order to help estimate students' cognitive learning style so that practitioners can deliver instruction in the most effective and efficient manner.

Subquestions

1. Which cognitive/learning style inventories are perceived as being widely used?

This question was posed in order to build a list of widely used inventories. Questions were also posed to give guidelines about what age groups the inventories had been used with, whether the experts were using the inventory currently, and which inventories the experts were familiar with but had not used. Information from this question was used to build Matrix B (see Chapter 5) which is a selection tool for practitioners.

2. What elements of cognitive/learning style inventories are perceived to differentiate effectively and efficiently among widely used inventories?

All inventories have cognitive (content) and technical (operational) elements. Both the technical and content elements can be important to the practitioner when selecting an inventory.

3. Are some elements in widely used cognitive/learning style inventories perceived as more important than other elements?

This question queried the experts to determine what elements were the most important and what elements the practitioner should look for in an inventory. Matrix C (see Chapter 5) was formulated from this list of elements and characteristics in order to aid the educational practitioner in choosing a specific inventory which might more effectively and efficiently meet her/his instructional goals.

4. What is the perceived range of elements of cognitive/learning style inventories in terms of their respective importance?

The results from this question were used to start to build a ranked list of elements and characteristics that were included in Matrix C.

5. What elements are perceived as important for a model that assists practitioners in selecting an appropriate cognitive/learning style inventory?

This was the base list in Matrix D (see Chapter 5), and again, was part of the selection tool that practitioners would use in selecting an inventory.

Descriptive statistics were used to report the results of all research questions.

Literature Support

Three areas of literature were reviewed for this study. The first area had to do with the methodology of this study. It was focused on research about and description of the Delphi methodology. The second area of review was the topic of cognitive/learning style. Research on cognitive/learning style assessment inventories was the final area of review for this study.

Computer searches of the electronic data bases of ERIC, Dissertation Abstract International, and Psychological Abstracts were used to find major portions of the literature related to these 3 areas. These data bases, according to Martha Meaders, an expert educational researcher of data bases at Michigan State University Library, should include most of the relevant information on cognitive/learning style, cognitive/learning style assessment inventories, and Delphi methodology. The various writings were reviewed to determine which ones were to be included in this study. A manual search of ERIC was done to pick pre 1966 articles since that is when the computer listings begin in ERIC. In addition, a number of books were read on each of the 3 areas. Also, major journals, relevant to the research, but not stored in any of the available electronic data bases, were studied. Material sent in by the experts as relevant to the research was reviewed. Some of the actual cognitive/learning style assessment inventories and manuals were used to help generate some of the first round questions for the Delphi.

POPULATION AND SAMPLE

Description of Population

The initial sample consisted of 41 professionals who had written or given presentations about cognitive/learning style assessment inventories. Of the 41 participants 40 had Ph.D.s or Ed.D.s, and all participants had some affiliation with a college or university. Most of the participants were either professors, lecturers or administrators at a university or college. There were 12 disciplines represented by the 41 participants. The disciplines were: Education (16 participants), Educational Psychology (4 participants), Science (1 participant), Psychology (5 participants), Educational Services (2 participants), Chemical Engineering (3 participants), Allied Health and Medicine (2 participants), Health and Physical Education (3 participants), Mathematics (1 participant), Zoology (1 participant), Educational Technology (1 participant), and Music (2 participants). The 41 participants came from 17 states and Washington, D.C. Geographically, 15 participants came from the Midwestern States, 6 participants came from the Southwestern States, 10 participants came from the Southern States, 6 participants came from the Eastern States, 1 participant came from the Western States, 1 participant came from the Southcentral States, and 2 participants came from Washington, D.C. In this study there were 29 males and 12 females. Table 1 summarizes the demographic data as well as the response rate by Round.

Table 1

Summary of Experts' Demographics and Response Rates

EXPERT	SEX	LOCATION	Ph.D. OR Ed.D.	DISCIPLINE	RD1	RD2	RD3
A	M	Southwest	Yes	Education	X	X	X*
B	M	East	Yes	Educational Psychology			
C	M	Midwest	Yes	Education	X	X	X
D	M	Midwest	Yes	Education	X	X	X
E	F	South	Yes	Education	X	X	X
F	M	Southwest	Yes	Science	X	X	X
G	M	Midwest	Yes	Educational Psychology	X	X	
H	M	Midwest	Yes	Psychology	X	X	X
I	M	South	Yes	Educational Services	X	X	X
J	M	South	Yes	Chemical Engineering	X	X	X
K	F	Southwest	Yes	Allied Health & Medicine	X	X	X
L	M	Midwest	Yes	Psychology	X		
M	M	South central	Yes	Education	X	X	X
N	M	South	No	Health & Physical Education	X	X	X

* "X" indicates expert participation in the Round

(Table 1 continued)

EXPERT	SEX	LOCATION	Ph.D. OR Ed.D.	DISCIPLINE	RD1	RD2	RD3
O	M	South	Yes	Education	X	X	X*
P	M	East	Yes	Education	X	X	X
Q	F	South	Yes	Health & Physical Education	X	X	
R	F	East	Yes	Education	X	X	X
S	M	Midwest	Yes	Education	X	X	X
T	M	Southwest	Yes	Zoology	X		
U	M	East	Yes	Psychology			
V	F	Midwest	Yes	Education	X	X	X
W	M	South	Yes	Education	X	X	X
X	F	Washington D.C.	Yes	Psychology	X	X	X
Y	M	Midwest	Yes	Health & Physical Education	X	X	X
Z	F	Washington D.C.	Yes	Educational Technology	X	X	X
AA	M	Midwest	Yes	Education	X	X	
BB	M	Midwest	Yes	Psychology			
CC	M	Midwest	Yes	Music	X	X	X

* "X" indicates expert participation in the Round

(Table 1 continued)

EXPERT	SEX	LOCATION	Ph.D. OR Ed.D.	DISCIPLINE	RD1	RD2	RD3
DD	F	Midwest	Yes	Music	X	X	X*
EE	M	West	Yes	Chemical Engineering	X	X	
FF	M	Midwest	Yes	Education	X	X	X
GG	M	East	Yes	Educational Psychology			
HH	M	Southwest	Yes	Chemical Engineering	X		
II	M	Midwest	Yes	Mathematics	X	X	X
JJ	F	South	Yes	Education	X	X	X
KK	M	East	Yes	Education	X	X	X
LL	M	Midwest	Yes	Education	X	X	X
MM	F	Southwest	Yes	Allied Health & Medicine	X	X	
NN	F	South	Yes	Educational Services	X	X	X
OO	F	South	Yes	Educational Psychology			

* "X" indicates expert participation in the Round

Sampling Procedure

Participants were chosen by reading the literature on cognitive/learning style assessment inventories and making a list of people who had written on or presented materials about cognitive/learning assessment inventories. Addresses and phone numbers of the initial list of 142 experts were obtained by using the literature and directories listing colleges and universities and professors. Also phone directories were used. Of the 142 experts, this researcher was able to contact 60 experts by telephone from the initial list. When a person was contacted, this researcher gave this phone contact speech.

> Hello, my name is Diane Genshaw. I am a graduate student at Michigan State University working on my dissertation. I am certainly glad to get in touch with you. My research is on learning style inventories, and it has come to my attention that you are knowledgeable in this area. (PERSONAL INFORMATION-including titles of their publications, speeches, or inventories) I am trying to get expert opinions and some consensus on what components or elements are needed in learning style inventories, and I would like to ask you to participate in a Delphi Study on cognitive/learning style inventories for this purpose.
>
> It is my goal to be a facilitator and bring together the best information about learning style inventories and share that information with the people in the field. Additionally, I hope to stimulate interest in the area by creating a practical tool for educators to use to try to determine what learning style inventory they should use in a given situation. Finally, I hope to gain some insight about what inventories are being used for what purposes. If you choose to participate, I will send you a copy of the results of this study. These results should give you an idea of what your colleagues are thinking and doing about cognitive/learning style assessment inventories.
>
> Of course your participation is voluntary and you may

choose to answer or not answer any question or to withdraw from the study at any time.

The first questions that will be posed to you are to list the technical and content components or elements that you believe are important in a learning style inventory and to check off any inventories that you have used or had familiarity with. This question will be sent to you. After you and other experts have responded to this question and the data has been processed, another set of questions based on the results from the first question will be sent to you. The last question will ask you to evaluate a learning style inventory which you are familiar with using a checklist developed from the previous rounds of the Delphi. It is anticipated that there will be 3 or 4 rounds with each round taking 30 minutes or possibly a little more of your time. There will be approximately 3 to 4 weeks between each round. At the latest, all rounds should be completed by early May.

Of course, all responses will be treated with strict confidence and all names will remain anonymous. It is anticipated that this research will add to the existing body of knowledge in the field, and will result in a practical tool that educators can use in the field. Would you be willing to participate?

If The Answer Was Yes

Thank you for your help. Your first mailing will be in about two weeks. I will be looking forward to your response. If you have any questions, you may call me collect at 517-355-8229 or write me at 924B Cherry Lane, E. Lansing, MI 48823. I will also include this phone number and address on all my mailings. Do you know names of other people who are knowledgeable in this area that you think might be willing to participate? Thank you again.

If The Answer Was No

Thank you for your time. If you think it over and change your mind, please feel free to call me collect at 517-355-8229. Do you know any names of other people who are knowledgeable in this area that you think might be willing to participate? Thank you again.

From the list of 60 experts , 41 agreed to participate in the study. To encourage continued participation over the 3 rounds, postcards were sent to remind participants that they had not returned their survey. However, the actual numbers of participants for each round were: 36 participants for Round 1, 33 participants for Round 2, and 28 participants for Round 3. All Round 2 participants had been included Round 1. Similarly, all Round 3 participants had been included in both previous rounds.

The sample was not selected randomly as this study was looking for expert opinions and most of the people who qualified as experts either worked or were affiliated with a university or college. The sample was selected using accepted criteria for choosing a Delphi panel.

> ...participants must have a deep interest in the problem and important knowledge or experience to share....Once the general characteristics of desired respondents are agreed upon, a nomination process should be used to select specific individual respondents. In other words, the work group should first identify target groups likely to possess relevant information or experiences concerning the objective toward which decision makers are aiming the Delphi. The staff should solicit nominations of well-known and respected individuals from members within the target groups if the Delphi is aimed at experts...(Delbecq et al., 1975, p.88).

By using journal articles, ERIC listings, <u>Dissertation Abstracts International</u>, <u>Psychological Abstracts</u>, and recommendations from other participants, the nominations came from varied resource bases. Using these resource bases assured that the participants would be knowledgeable in the area, and have some interest in the area.

The sample size of each Delphi Round varied from 28 to 36. Delbecq (1975) states the sample size of a Delphi can vary from 10 to 15 in a homogenous group to several hundred. However, "Our experience indicated that few new ideas are generated within a homogeneous group once the size exceeds thirty well-chosen participants (p. 89). Since this group is homogenous in terms of their area of expertise and well-chosen, the numbers match the criteria for Delphi studies.

INSTRUMENTATION

Reliability and Validity of Instruments

According to Linstone and Turoff (1975) the validity of the Delphi is in the procedure.

> The procedure is about as pure and perfect a Lockean procedure as one could ever hope to find because, first, the 'raw data inputs' are the opinions or judgments of the experts; second, the validity of the resulting judgment of the entire group is typically measured in terms of the explicit 'degree of consensus' among the experts (p. 22).

Also content-related validity was used in this study. Content-related validity is the degree to which a sample of items represents the content that the questionnaire is designed to measure. A literature review and expert opinions (American Psychological Association, 1985) are 2 of the methods used as the basis for content-related validity. For Round One both an expert opinion survey and a literature search was conducted to sample the content of cognitive/learning style assessment inventories. Rounds 2 and 3 were built from the expert opinions from the previous rounds.

Design

Round 1 Delphi

Items for the questionnaire of Round 1 of the Delphi were developed by using a literature review. According to Turoff (1975) most Delphis try to maintain a 3 to 4 round limit in order to keep the participation of the experts. This 3 to 4 round limit is accomplished, in part, by preformulating the obvious issues and preceding the initial list with a range of options but allowing the experts to add to this initial list. Generally, the range of options or the preformulation is accomplished by reviewing the literature (Moore 1987; Young 1977; Linstone & Turoff 1975; Weatherman & Swenson 1974; Sweigert & Schabacker 1974).

There were 4 parts to Round 1 (see Appendix A). The first part asked the experts what cognitive/learning style assessment inventories they had used, what age group they used them with, and when they last used them. It also asked what cognitive/learning style assessment inventories they were familiar with but had not used. Eighteen inventories were listed, and experts were encouraged to add any inventories not on the list.

Part 2 of Round 1 (see Appendix A) asked the experts to determine which cognitive (content) elements should be measured by a cognitive/learning style assessment inventory. Different elements of physical, affective, sociological, sensory, and inference components were listed. Participants were asked to add any additional elements that they thought were important. Any elements that participants thought were important, they marked with an "X".

Part 3 of Round 1 (see Appendix A) asked the experts to determine which technical (operational) elements should be measured by a cognitive/learning style assessment inventory. Eight major elements were listed. They were: (1) time needed to test, (2) test booklet, (3) total cost (scoring, booklet, score sheets), (4) manuals, (5) what manuals should report, (6) inventory administration procedures, (7) scoring, and (8) student response to inventory. Under each element, subelements were listed for the experts' consideration. Participants were asked to add any additional technical elements that they thought were important. Any elements the participants thought were important, they were asked to mark with an "X".

Part 4 of Round 1 (see Appendix A) asked the experts to define 3 terms and complete 2 open-ended questions. They were asked to define learning style, cognitive style, and inventories. The 2 open-ended questions were: (1) The reason(s) I use or have used the inventories is (are), and (2) My disappointment(s) when using the inventories is (are). Participants were asked not to leave blank spaces. If they felt unprepared to answer any question or term they were asked to draw a line to indicate that they had seen the question and decided not to answer it. If they felt any of the terms were the same, they were asked to define the first term and write same as __________ for the second or third term, (see Appendix A).

The Round 1 questions were sent to participants on February 26, 1990. Each respondent received: a cover letter, the Delphi questions and a self addressed stamped envelope. The cover letter asked participants to copy their responses if they wanted to keep track of their answers, and to return the survey by March 7, 1990. On March 13, 1990 postcards were sent out to 18 participants who had not responded initially to remind them to return the survey. After the postcards, 13 more participants returned the survey making a total of 36 participants.

Round 2 Delphi

The items in Round 2 were developed using the data from the Round 1 responses. In the Delphi technique,

> The procedure calls for iteration in eliciting perceptions from participants, so that they make a series of judgments, each successive one being made in the light of a summary of judgments of all participants on the previous round. This process is designed to produce increasing accuracy of judgment and increasing agreement among participants from round to round. (Sweigert and Schabacker, 1974, p. 2)

There were seven major parts to Round 2 (see Appendix B). All items selected and added by the experts in Round 1; parts 1, 2, and 3 were listed out and the experts were asked to rank the items. For each of the major cognitive elements of cognitive/learning style (physical, affective, sociological, sensory, and inference), and for each of the major technical elements of cognitive/learning style (time needed to test, test booklet, total cost, manuals, manuals should report, inventory administration procedures, Scoring, and Student response to inventory) the experts were given 10 points to distribute among subelements of each major element. This was done for parts 1 and 2. Participants were also given 10 points for 2 blocks in part 3 to rank the major elements of style in the cognitive and technical areas. Participants were given these directions for parts 1, 2, and 3:

> In each block you have 10 POINTS. Distribute your points so that the greatest amount of points goes to the element(s) that you think are the most important, and the least amount of points goes to the element(s) that you think are the least important. Some elements within a block can have the same amount of points, "0" points, or one element in a block can have all 10 points. Use only whole numbers.

Parts 4, 5, 6 and 7 asked the experts to rank specific items:

Part 4-characteristics of learning style,

Part 5-characteristics of cognitive style,

Part 5-characteristics of cognitive/learning style inventories,

Part 6-reasons to use cognitive/learning style inventories, and

Part 7-disappointments with cognitive/learning style inventories.

In parts 4, 5, 6, and 7, participants were given the same directions that they were given in parts 1, 2 and 3 except they were given 25 points to distribute. Round 2 was sent to the participants on April 9, 1990. Each mailing included a cover letter, the Delphi questions and a self addressed stamped envelope. The cover letter asked participants to copy their responses if they wanted to keep track of their answers, and to return the survey by April 16, 1990. The cover letter also gave a summary of the Round 1 responses. On May 2, 1990 postcards were sent out to 11 participants to remind them to return the survey. After the postcards, 4 more participants returned the survey. One person withdrew from the study. A total of 33 responses were received for the second round.

Round 3 Delphi

The questions in Round 3 were developed from the responses in Round 2 (see Appendix C). Only 1 new item was added. It was added as a response to a written comment from one of the participants. Participants were given ranked lists of elements, subelements, disappointments with, and reasons for using cognitive/learning style assessment inventories (the ranking was developed from the previous rounds). Additionally, asterisks divided 2 rankings that were separated by 10 or more points. Then participants were asked to comment on each ranking if they desired to comment. If they did not comment on any ranking, that meant they agreed with the ranking. There were 18 blocks of ranked items. Some blocks were very long containing as many as 48 items.

Round 3 materials were sent to participants on September 2, 1990. Each mailing included a cover letter, the Delphi questions, and a self addressed, stamped envelope. As in previous rounds, the cover letter asked participants to copy their responses if they wanted to keep track of their answers, and to return the survey by October 1, 1990. The cover letter gave a summary of Round 2. The total number of returns were 28. On October 7, 1990, postcards were sent out to 11 participants to remind them to return the survey. After the postcards, no new surveys were returned.

The total percentages of returns were 87.8%, 80.5%, and 68.3% for the 3 rounds. The time lag between Round 2 and Round 3 took into consideration that professors are often gone over the summer months. Also the extended time given to the experts to respond to Round 3 reflected comments by the experts that they did not have enough time to respond on the 2 previous rounds.

DATA COLLECTION PROCEDURES

Resources Required

Since the Delphi is a survey done usually in at least 3 rounds it required chiefly only the resources of this researcher who was the compiler and manager of the information. Members of the researcher's dissertation committee provided input to the revision of the questions for each round. A typist was used to type and format the surveys. Sent to the participants were surveys, reminder postcards, and self addressed stamped envelopes. Additional envelopes were used to mail the Delphi materials to the participants.

Training Required

This researcher had to review the literature on cognitive/learning style assessment inventories and on the Delphi Technique to:

1. Learn how to direct a Delphi Study,
2. Determine what cognitive/learning style elements needed to be in the initial survey,
3. Determine what cognitive/learning style assessment inventories were popular and available to include in the first survey,
4. Determine what were some of the disappointments with cognitive/learning style assessment inventories to include in the first survey, and
5. Determine what were some of the reasons practitioners used cognitive/learning style assessment inventories to include in the first survey.

The most important resource needed in any Delphi Study, and this research was no exception, was time. This process took more time than most survey methods because it consisted of 3 separate rounds of data collection.

PLAN FOR ANALYZING DATA

Statistical Treatment of Data

Validity

Because Round 1 questions were developed by this researcher, the question of validity must be addressed. Traditionally, evidence of validity evidence has been grouped into 3 major categories (American Psychological Association, 1985). These categories are content-related, criterion-related, and construct-related. Criterion-related and construct-related validity were tested by this researcher because of insufficient data from previous studies and lack of available instruments to test the variables in this study.

Content-related validity is the degree to which a sample of items represents the content that the questionnaire is designed to measure. Unlike other types of validity, content-related validity is tested subjectively (Borg & Gall, 1979). A literature review and expert opinions (American Psychological Association, 1985) are 2 of the methods used as the basis for content-related validity. For Round 1 an expert opinion survey and a literature search were conducted to sample the content of cognitive/learning style assessment inventories. Rounds 2 and 3 were built from the expert opinions from the previous rounds.

Data Analysis Round 1

In Round 1 the questions were developed by using a literature search and expert opinions. Computer searches of ERIC, Dissertation Abstract International, and Psychological Abstracts were used to help develop the questions. A manual search of ERIC was done to include any literature that was written before 1966 when the computer listings began in ERIC. A number of books written about cognitive/learning style assessment inventories were reviewed by this researcher. Manuals and test booklets of cognitive/learning style assessment inventories were reviewed in order to develop some of the cognitive and technical questions for the first round. Experts that were contacted by telephone added material to be used in the questions for Round 1. Experts on this researcher's dissertation committee also suggested questions for Round 1. The expert opinions and the literature search met the guidelines for content-related validity according to Borg and Gall (1979) and the American Psychological Association (1985). Round 1 had some background questions about what cognitive/learning assessment inventories the experts had used, when the experts had used the inventories, and with what age groups the experts had used the inventories. These responses were tabulated to determine widely used inventories and information about their use. These responses were not used in Rounds 2 and 3.

Round 2 Data Analysis

All responses from the experts in Round 1 were recorded. Duplicate responses were discarded. Responses that had 2 or more ideas were broken apart so that there was only 1 idea per statement. Then the responses were arranged into categories already established in Round 1 (see Appendix B). No rank, order or weight was given to any of the responses. All responses were sent back to the original list of 41 experts. The instructions to the experts read:

> Below are the responses you chose in Round 1. In each block you have 10 or 25 (depending on the block) POINTS.Distribute your points so that the greatest amount of points goes to the element(s), characteristic(s), reason(s) to use, or disappointment(s) with (depending on the block) that you think is/are the most important, and the least amount goes to the element(s) that you think is/are the least important. Some elements in the block can have the same amount of points, "0"(zero) points or one element in a block can have all 10 points. Use only whole numbers. (see Appendix B)

When the 33 responses were returned, all the points in each block were totaled. Responses were put in a ranked order. If more than 10 points separated any 2 items, the items were separated by a row of asterisks. All the responses receiving "0"(zero) points were recorded as receiving "0"(zero) points.

Round 3 Data Analysis

The ranked list was sent out to the 41 original participants. The directions that were sent out to the participants were:

> Here is the last Delphi Survey on cognitive/learning style inventories in which you have been participating. Please read the results and make appropriate comments, if desired, in the spaces provided. Note: A ranking of "1" indicates the element or characteristic that received the most points as determined by the respondents. In addition, a line of asterisks dividing two rankings means that there are more than 10 points separating those two rankings.

Descriptive statistics were used in this research to report the results of the Round Three questionnaire. Results are reported in percentages, mean, and median. A narrative was used to give minority, opposing, or differing positions that the experts expressed in the comment section.

Decision Rules for Interpreting Data

All responses by the experts were recorded and reported. Responses that received "0" (zero) responses in Round 1 were deleted. Responses that received "0" (zero) responses in Rounds 2 and 3 were reported. They were reported to give feedback to the participants and were not used in the statistical process to remain consistent with Round 1. At decision making junctures in the flow chart, criteria were given for each decision point (see flow chart in Chapter 5).

Presentational Format Used to Present Findings

Tables, a flow chart and matrices in conjunction with a narrative were used to illustrate findings.

SUMMARY

In this chapter this researcher outlined the research design. The purpose of developing a model for evaluating and choosing among widely used assessment inventories of cognitive/learning style in order to aid practitioners in selecting an appropriate assessment inventory was stated. How experts were chosen and contacted for this Delphi, which was the research methodology in this study, were outlined. The mailing dates of each round of the Delphi study were given. The population of this Delphi study was defined.

The primary and subquestions of this research were listed and reasons were given for the individual questions and subquestions. Areas of the literature that were reviewed and searched for this study were given. The 3 areas of literature reviewed for this study were: the Delphi Method, cognitive/learning style, and cognitive/learning style assessment inventories. The data bases and other literature that was searched was discussed.

The educational background, degree status, content area specialty, geographical location, and gender of the 41 participants of the study were described. The procedure for obtaining participants by using the literature was outlined. The phone contact speech was described. The number of participants in each round of the Delphi study was given. Justification of the nonrandom sampling procedure was presented.

Data collection procedures were reported. Resources and training required for collecting the data were outlined.

Instrumentation design and development were outlined. How the questions for each of the 3 rounds of this Delphi were developed and specific areas the questions covered were discussed. Mailing dates for the each round and the reminder postcards were given. Instrumentation reliability and validity were presented.

Next the plan for analyzing the data was presented. The descriptive statistics used in this study were reported. Flow chart decision points were discussed. The presentational formats of matrices, tables and a flow chart that were used in this study were outlined.

CHAPTER 4

DATA ANALYSIS AND FINDINGS

In this chapter the 5 research questions are stated,the data is analyzed, and the findings are presented. Additionally, there is presented a statement of findings across all of the questions to show relationships.

Data Collection and Analysis

Data Collection

The Delphi Method was used as the research methodology. Three instruments or rounds were sent to each of the 41 participants in the study. Participants were chosen by reading the literature on cognitive/learning style assessment inventories and making a list of people who had written on or presented materials about cognitive/learning style assessment inventories. The first round of the Delphi presented a series of broad questions and each subsequent round built on the responses from the previous rounds. The object was to achieve consensus among the experts. Results from the 3 Delphi Rounds assisted the researcher to respond to the research questions.

<u>Data Analysis</u>

In Round 1, the questions were developed by using a literature search and expert opinions. The expert opinions and the literature search met the guidelines for content-related validity according to Borg and Gall (1979) and the American Psychological Association (1985).
All responses from the experts in Round 1 were recorded. Duplicate responses were discarded. Responses that had 2 or more ideas were broken apart so that there was only 1 idea per statement. Then the responses were arranged into categories already established in Round 1 (see Appendix B). No rank, order or weight was given to any of the responses. All responses were sent back to the original list of 41 experts. The experts were asked to weight responses by distributing points. When the 33 responses were returned, all the points in each block were totaled. Responses were put in a ranked order, and if more than 10 points separated any two items it was noted. All responses receiving "0" (zero) points were recorded as receiving "0" (zero) points.

In Round 3, a ranked list was sent out to the 41 original participants. The participants were asked to make comments about the ranked lists to indicate agreement with or without comments or disagreement with comments. Descriptive statistics (percentages, mean, and median) were used to report the results. A narrative was used to give minority, opposing, or differing positions that the experts expressed in the comment section.

DATA ANALYSIS AND FINDINGS BY QUESTION

Question 1

Statement of Question

Which cognitive/learning style inventories are perceived as being widely used

Analysis of Data and Statement of Findings

Part 1 of the Round 1 questionnaire queried respondents about Question 1. Contained in this part of the Round were these elements:

1. Directions for this part of the inventory,
2. 17 sample inventories and blank spaces for the respondents to put in additional inventories,
3. A column to check if the respondent had used or was very familiar with a particular inventory,
4. A column for the respondent to indicate the age groups with which they had used a particular inventory
5. A column for the respondent to indicate the date they had last used a particular inventory (see Appendix A for the complete Part 1 inventory).

Return Rate

Thirty-six (87.8%) of the experts completed the preceding part of the Delphi Survey.

Results

The results of Part 1 Round 1 are presented in Table 2 The experts in this study added 12 inventories that they had used or with which they were familiar. Of the 12 inventories they added, they used 4 of the inventories and were only familiar with the remaining 8 inventories.

They indicated with what age groups (preschool, grades k-5, grades 6-8, grades 9-12, and adults) with whom they had used the inventories. The majority of the experts used the inventories with adults. Experts used the inventories with the preschool age group the least.

Finally, the experts indicated when they had used the inventory. Inventories had been used from 1970 through the time that the Delphi was run which was 1990.

In Table 3 specific inventories were analyzed to determine what percent of the respondents used inventory, and what was the total percent of utilization and familiarization. Also a rank (with the number 1 being the most used and familiar) was established. If 2 or more inventories had the same rank, those inventories were listed in alphabetical order. Three inventories were ranked first by the experts. They were: Dunn, Dunn and Price-Learning Style Inventory, Kolb-Learning Style Inventory and Myer and Briggs-Myer-Briggs Type Indicator. These 3 inventories were used and/or were familiar to 72.22% of the experts in this

Table 2

Results of Part 1 Round 1: Widely Used

Cognitive/Learning Style Inventories

INVENTORY	USED(U) VERY FAMILIAR WITH(F)		AGE RANGES PRESCHOOL(P) GRADES K-5(E) GRADES 6-8(M) GRADES 9-12(H) ADULT(A)					LAST DATE USED
INVENTORY	U	F	P	E	M	H	A	DATES USED
Canfield Learning Style Inventory	12	6			1	1	11	90(2):89(3) 87:85:83:79*
Dunn, Dunn,& Price Learning Style Inventory	14	12		6	7	6	4	90(3):89(2)88(3) 87(2)85:84:80:79
French, Ekstrom & Price-Hidden Figures Test	7	2				2	6	90(3):89(2)88 82
Gregorc-Transaction Ability Inventory	7	6			1		6	90:89(2):88(2) 87
Hill-Cognitive Style Interest Inventory	6	10		1	2	2	4	90(2):86:82:79 76
Kagan-Matching Familiar Figures Test	12	6	1	9	7	3	4	89:88:86:85(2) 83:75(2):72
Keefe-NASSP Learning Style Profile	8	8			5	7	4	90(4):89(2):88
Kolb-Learning Style Inventory	15	11			1	3	15	90(6):89(5) 86(2):85:81
Letteri-Cognitive Profiles	4	6		3	3	3	3	90(2):89(2)

*Numbers in parenthesis indicate how many experts used the inventory. No number after the date indicates that only 1 expert used the inventory.

(Table 2 continued)

INVENTORY	USED(U) VERY FAMILIAR WITH(F)		AGE RANGES PRESCHOOL(P) GRADES K-5(E) GRADES 6-8(M) GRADES 9-12(H) ADULT(A)					LAST DATE USED
INVENTORY	U	F	P	E	M	H	A	DATES USED
Myer & Briggs-Myer-Briggs Type Indicator	14	12			1	4	12	90(2):89(3) 88:87:86:85(2) 84:81:80
Papalia-Learning Style Modalities		3						
Reinert-Edmonds-Edmonds Learning Style Identification Exercise (ELSIE)	3	4				1	1	89(2):87
Renzulli & Smith Learning Style Inventory	3	7			1	1	2	89:84:79
Schmeck-Inventory of Learning Processes		7						
Sigel-Test of Conceptual Style	3	4		2	3	2		80:72:70
Torrance-Your Style of Learning Thinking	8	7					7	90(2):89(2):86 85:80
Witkin-Embedded Figures Test	14	11	1	3	5	5	12	90(2):89(2):88 86:80(2):78(2) 70
Witkin-Group Embedded Figures Test	18	6		2	5	9	17	90(4):89(4):88 87:85:83:80(2) 78:70
Barbe/Swassing-Barbe/Swassing Modality Kit		2	2			2		90(2)
Brown & Cooper	1						1	89

(Table 2 continued)

INVENTORY	USED(U) VERY FAMILIAR WITH(F)		AGE RANGES PRESCHOOL(P) GRADES K-5(E) GRADES 6-8(M) GRADES 9-12(H) ADULT(A)					LAST DATE USED
INVENTORY	U	F	P	E	M	H	A	DATES USED
Coscarelli & Stonewater-Decision Making Inventory		1						
Grasha-Riechmann Student Learning Styles		1						
Hunt Conceptual Level	1						1	90
Lowentral-Visual Haptic		1						
Malcom et.al.-Learning Style Identification Scale		1						
McCarthy-4-Mat System		2						
Murdock-Teaching Center Learning Style Inventory	1			1				85
Rezler-Learning Preference Inventory		1						
Steinberg-Thinking Styles Inventory		1						
Witkin-Children's Embedded Figures Test	2			2	1			88:82

Table 3

Usage and Familiarization by the Experts of Widely Used Inventories of Cognitive/Learning Style

INVENTORY	% USED	% ONLY FAMILIAR	TOTAL % (USED & FAMILIAR)	RANK (USED& FAMIL-IAR)
Dunn, Dunn & Price-Learning Style Inventory	38.89	33.33	72.22	1
Kolb-Learning Style Inventory	41.67	30.55	72.22	1
Myer & Briggs-Myer-Briggs Type Indicator	38.89	33.33	72.22	1
Witkin-Embedded Figures Test	38.39	30.55		4
Witkin-Group Embedded Figures Test	50.00	16.67	66.67	5
Canfield-Learning Style Inventory	33.33	16.67	50.00	6
Kagan-Matching Familiar Figures Test	33.33	16.67	50.00	6
Hill-Cognitive Style Interest Inventory	16.67	27.78	44.44	8
Keefe-NASSP Learning Style Profile	22.22	22.22	44.44	8
Torrance-Your Style of Learning & Thinking	22.22	19.44	41.67	10

(Table 3 continued)

INVENTORY	% USED	% ONLY FAMILIAR	TOTAL % (USED & FAMILIAR)	RANK (USED & FAMILIAR)
Gregorc-Transaction Ability Inventory	19.44	16.67	36.11	11
Letteri-Cognitive Profiles	11.11	16.67	27.78	12
Renzulli & Smith-Learning Style Inventory	8.33	19.44	27.79	12
French, Ekstrom & Price-Hidden Figures Test	19.44	5.55	25.00	14
Reinert-Edmonds-Edmonds Learning Style Identification Exercise	8.33	11.11	19.44	15
Schmeck-Inventory of Learning Processes	0.00	19.44	19.44	15
Sigel-Test of Conceptual Style	8.33	11.11	19.44	15
Barbe/Swassing-Barbe/Swassing Modality Kit	5.55	5.55	11.11	18
Papalia-Learning Style Modalities	0.00	8.33	8.33	19
McCarthy-4MAT Inventory	0.00	5.55	5.55	20
Witkin-Children's Embedded Figures Test	5.55	0.00	5.55	20

(Table 3 continued)

INVENTORY	% USED	% ONLY FAMILIAR	TOTAL % (USED & FAMILIAR)	RANK (USED& FAMIL-IAR)
Brown & Cooper	2.78	0.00	2.78	22
Coscarelli & Stonewater-Decision Making Inventory	0.00	2.78	2.78	22
Grasha & Riechman-Student Learning Styles	0.00	2.78	2.78	22
Hunt-Conceptual Level	2.78	0.00	2.78	22
Lowentral-Visual/ Haptic	0.00	2.78	2.78	22
Malcolm et.al.-Learning Style Identification Scale	0.00	2.78	2.78	22
Murdock-Teaching Center Learning Style Inventory	2.78	0.00	2.78	22
Rezler-Learning Preference Inventory	0.00	2.78	2.78	22
Steinberg-Thinking Styles Inventory	0.00	2.78	2.78	22

study. Two of the instruments, Dunn, Dunn and Price-Learning Style Inventory and Myer and Briggs-Myer-Briggs Type Indicator are multidimensional instruments. Nine inventories were used and/or were familiar to only 2.78% of the experts in this study. These inventories ranked 22 (last) in this study. Of the last 9 inventories (those that ranked 22), only 3 of them were actually used by the experts.

In Table 4 is listed how often an inventory was used by the experts. Inventories that were not used by the experts were not listed. Inventories were arranged by rank, and if 2 or more inventories had the same rank, they were arranged in alphabetical order. The rank of 1 indicated the most frequently used inventory. The 5 inventories that were used most by the experts were: Witkin-Group Embedded Figures Test, Kolb-Learning Style Inventory, Dunn, Dunn, & Price-Learning Style Inventory, Myer and Briggs-Myer-Briggs Type Indicator, and Witkin Embedded Figures Test. Of the 36 experts that responded to this part of Round 1, 18 or 50% had used the top ranked inventory, Witkin's Group Embedded Figures Test. The 3 inventories that were used least often, Brown and Cooper, Hunt-Conceptual Level, and Murdock-Teaching Center Learning Style Inventory were each used by only 1 expert.

Table 5 summarizes the data in relationship to age groups. The most <u>used</u> inventories, reported by the experts in this study, are listed first. A number 1 indicated the inventory selected most often by the experts. If 2 or more

Table 4

Most Frequently Used Inventories of Cognitive/Learning Style by the Experts

INVENTORY	NO. OF EXPERTS THAT USED	RANK
Witkin-Group Embedded Figures Test	18	1
Kolb-Learning Style Inventory	15	2
Dunn, Dunn & Price-Learning Style Inventory	14	3
Myer & Briggs-Myer-Briggs Type Indicator	14	3
Witkin-Embedded Figures Test	14	3
Canfield-Learning Style Inventory	12	6
Kagan-Matching Familiar Figures Test	12	7
Keefe-NASSP Learning Style Profile	8	8
Torrance-Your Style of Learning & Thinking	8	8
French, Ekstrom & Price-Hidden Figures Test	7	10
Gregorc-Transaction Ability Inventory	7	10
Hill-Cognitive Style Interest Inventory	6	12
Letteri-Cognitive Profiles	4	13
Reinert-Edmonds-Edmonds Learning Style Identification Exercise	3	14

(Table 4 continued)

INVENTORY	NO. OF EXPERTS THAT USED	RANK
Renzulli & Smith-Learning Style Inventory	3	14
Sigel-Test of Conceptual Style	3	14
Barbe/Swassing-Barbe/Swassing Modality Kit	2	17
Witkin-Children's Embedded Figures Test	2	17
Brown & Cooper	1	19
Hunt-Conceptual Level	1	19
Murdock-Teaching Center Learning Style Inventory	1	19

Table 5

Ranked Inventories as Classified by Age Groups

AGE GROUP	INVENTORY	RANK
PRESCHOOL	Kagan-Matching Familiar Figures Test	1
ELEMENTARY Grades K-5	Witkin-Embedded Figures Test	1
	Dunn, Dunn & Price-Learning Style Inventory	2
	Letteri-Cognitive Profiles	3
	Witkin-Embedded Figures Test	3
	Barbe/Swassing-Modality Kit	5
	Sigel-Test of Conceptual Style	5
	Witkin-Group Embedded Figures Test	5
	Hill-Cognitive Style Interest Inventory	8
	Murdock-Teaching Center Learning Style Inventory	8
MIDDLE SCHOOL Grades 6-8	Dunn, Dunn, & Price-Learning Style Inventory	1
	Kagan-Matching Familiar Figures Test	1
	Witkin-Group Embedded Figures Test	3
	Witkin-Embedded Figures Test	3

(Table 5 continued)

AGE GROUP Grades 6-8	INVENTORY	RANK
	Letteri-Cognitive Profiles	5
	Keefe-NASSP Learning Style Profile	5
	Sigel-Test of Conceptual Style	5
	Hill-Cognitive Style Interest Inventory	8
	Canfield-Learning Style Inventory	9
	Gregorc-Transaction Ability Inventory	9
	Kolb-Learning Style Inventory	9
	Myer & Briggs-Myer-Briggs Type Indicator	9
	Renzulli & Smith-Learning Style Inventory	9
	Witkin-Children's Embedded Figures Test	9
HIGH SCHOOL Grades 9-12	Witkin-Group Embedded Figures Test	1
	Keefe-NASSP Learning Style Profile	2
	Dunn, Dunn & Price Learning Style Inventory	3
	Witkin-Embedded Figures Test	4
	Myer & Briggs-Myer-Briggs Type Indicator	5

(Table 5 continued)

AGE GROUP Grades 9-12	INVENTORY	RANK
	Kagan-Matching Familiar Figures Test	6
	Kolb-Learning Style Inventory	6
	Letteri-Cognitive Profiles	6
	French, Ekstrom & Price-Hidden Figures Test	9
	Hill-Cognitive Style Interest Inventory	9
	Sigel-Test of Conceptual Style	9
	Canfield-Learning Style Inventory	12
	Reinert-Edmonds-Edmonds Learning Style Identification Exercise	12
	Renzulli & Smith-Learning Style Inventory	12
ADULT	Witkin-Group Embedded Figures Test	1
	Kolb-Learning Style Inventory	2
	Witkin-Embedded Figures Test	3
	Myer & Briggs-Myer-Briggs Type Indicator	4
	Canfield-Learning Style Inventory	5
	Torrance-Your Style of Learning & Thinking	6
	French, Ekstrom & Price-Hidden Figures Test	7

(Table 5 continued)

AGE GROUP ADULT	INVENTORY	RANK
	Gregorc-Transaction Ability Inventory	8
	Dunn, Dunn & Price-Learning Style Inventory	9
	Hill-Cognitive Style Interest Inventory	9
	Kagan-Matching Familiar Figures Test	9
	Keefe-NASSP Learning Style Profile	9
	Letteri-Cognitive Profiles	13
	Renzulli & Smith-Learning Style Inventory	14
	Brown & Cooper	15
	Hunt-Hunt Conceptual Level	15
	Reinert-Edmonds-Edmonds Learning Style Identification Exercise	15

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inventories had the same rank, those inventories were listed in alphabetical order.

Only 1 inventory, Matching Familiar Figures Test was used with preschoolers. However, 17 inventories were used with adults. The Matching Familiar Figures Test was used with all age groups. In the elementary grades (K-5) the Witkin Embedded Figures Test was used most often, in middle school (grades 6-8) Dunn, Dunn, and Price-Learning Style Inventory and Kagan-Matching Familiar Figures Test were used most often, in high school (grades 9-12) the Witkin-Group Embedded Figures Test was used most often, and with adults the Witkin-Group Embedded Figures Test was used most often. If the preschool age group is eliminated there are 6 inventories that are used for all other age groups. They are: Kagan-Matching Familiar Figures Test, Witkin-Embedded Figures Test, Witkin-Group Embedded Figures Test, Dunn, Dunn, and Price-Learning Style Inventory, Hill-Cognitive Style Interest Inventory, and Letteri-Cognitive Profiles.

Figure 2 summarizes the data about the age groups with which the experts used the cognitive/learning assessment inventories.

Question 2

Statement of the Question

Which elements of cognitive/learning style inventories are perceived to differentiate effectively and efficiently among widely used inventories?

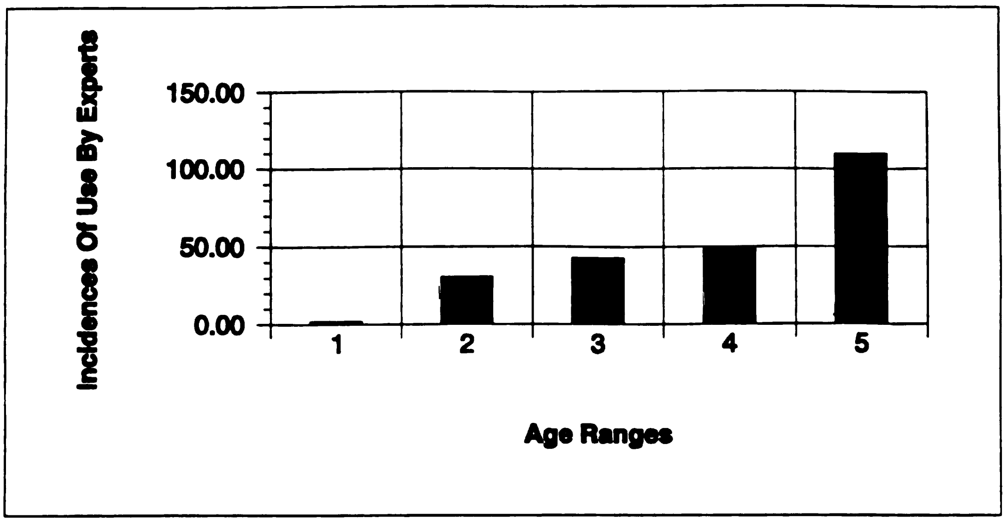

FIGURE 2
USE OF INVENTORIES BY AGE RANGES

Analysis of Data and Statement of Findings

ROUND 1

In Round 1 of the Delphi, a list of elements found in cognitive/learning style inventories developed by a literature review was sent to the experts, and they were asked to mark any element that they felt should be measured by a learning/cognitive style inventory. Also, they were asked to add any other elements that they felt were important.

Return Rate for Round 1

Forty-one experts agreed to participate in this study. In Round 1, 36 (87.8%) of the experts returned the survey.

Results

A literature search by this researcher and the experts developed the preceding list of important elements in Round 1.

COGNITIVE DIMENSION

Physical Elements

sound	warmth
mobility	time preference
light	design of learning environment

<u>Affective Elements</u>

motivation	responsibility
thinking/feeling	judgment/perception
tolerance of ambiguity	leader/follower
persistence	sensing/intuition
extroversion/introversion	anxiety levels
locus of control	past/present/future orientation
proxemics*	empathy*
histrionics*	

*Added by the Experts

<u>Sociological Elements</u>
Learns Best:

with peers	alone
in a varied mode	with authority figure
in mixed teams	

<u>Sensory Orientation</u>

auditory	kinesthetic
visual	in a varied mode
tactile	

<u>Inference Modalities</u>

field dependence/independence	complexity/simplicity
serial/simultaneous	random/sequential
reflective/impulsive	leveling/sharpening
abstract/concrete	structure/looseness
self direction/need for structure*	analytical/global*
verbal/spatial preference*	analytical/categorical/ inferential*
focusing/scanning*	

*Added by the Experts

TECHNICAL DIMENSION

<u>Time Needed To Test</u> (for most purposes)

15 min. or less	30 min. or less
45 min. or less	60 min. or less
2 hrs. or less	time is unimportant

<u>Test Booklet</u>

should be reuseable	students should be able to write in it
younger students-should be able to write in it*	older students-should be reuseable*

*Added by the Experts

Total Cost (Scoring, Booklet, Score Sheets)

.25 or less per pupil	.76-1.00 per pupil
.26-.50 per pupil	1.01-2.00 per pupil
.51-.75 per pupil	cost is unimportant

Manuals

should include examiner's manual
examiner's manual should have graphs and charts
examiner's manual should have a bibliography
should have a scoring key*
should have follow up on how to get specific information on variables*

*Added by the Experts

Manuals Should Report

development of inventory	inventory validity
inventory reliability	interpretation of scoring
norms*	types of validity*
how, why, & which items are weighted*	how it meets all APA standards*

*Added by the Experts

Inventory Administration Procedures

oral	visual(e.g.pictures, charts, models, & graphs)
written	
mixed mode	

Scoring

hand scored	machine scored
both should be possible (hand & machine)*	

*Added by the Experts

Student Response to Inventory

written	oral
visual	movement (kinesthetic)
mixed mode	

Eighty-six important elements were identified in Round 1 of the Delphi. The experts chose 69 elements identified by the literature review, conducted by this researcher, as important and added 17 additional elements that they thought were important to differentiate effectively and efficiently among widely used inventories. This was the list that the experts ranked for Question 3.

Question 3

Statement of Question

Are some elements in widely used cognitive/learning style inventories perceived as more important than other elements?

Analysis of Data and Statement of Findings

ROUND 2

In Round 2 the experts were asked to rank the elements they had selected in Round 1. The directions they were given were:

> Below are the responses you chose in Round 1. In each block you have 10 POINTS. Distribute your points so that the greatest amount of points goes to the element(s) that you think is/are the most important, and the least amount of points goes to the elements(s) that you feel is /are the least important. Some elements within a block can have the same amount of points, "0" points, or one element in a block can have all 10 points. Use only whole numbers.

Return Rate For Round 2

Forty one experts agreed to participate in this study. In Round 2, 33 (80.5%) experts returned the study.

Response Rate For Round 2

In some blocks some of the experts chose not to respond. Table 6 summarizes the response rate by block of the 33 experts who returned Round 2. Response rates ranged from 83.8% to 93.9% Only one element, time needed to test, received the lowest response rate of 83.8%. Out of 13 elements, 8 received the highest response rate of 93.9%. Actual numbers of experts who answered each block ranged from 28 to 31. The experts were also asked to rank the cognitive and technical elements categories. The response rates for the cognitive element category was 90.9%, and the response rate for the technical element category was 90.9%. The actual number of experts who answered each of these blocks was 30.

Results

Table 7 is a summary of the points the experts assigned to each subelement in each block. Also the rank derived from the points is included. The highest number of points and the lowest rank indicated the subelement perceived as the most important element to be examined in the inventories by the experts in this study; conversely the lowest number of points and the highest rank indicated the subelement perceived as the least important to be examined in the inventories by the

Table 6

Response Rates for Round 2 by Block

Major Heading	Element	Block No.	Response Rate %
Cognitive Elements	Physical	1	93.9
	Affective	2	90.9
	Sociological	3	93.9
	Sensory Orientation	4	93.9
	Inference Modalities	5	90.9
Technical Elements	Time Needed to Test (for most purposes)	1	84.8
	Test Booklet	2	87.9
	Total Cost (scoring, booklet, score sheets)	3	87.9
	Manuals	4	93.9
	Manuals Should Report	5	93.9
	Inventory Administration Procedures	6	93.9
	Scoring	7	93.9
	Student Response to Inventory	8	93.9

Table 7

Points and Ranks for Subelements of Cognitive/Learning Style

Major Heading	Element	Subelement	Total Points	Rank
cognitive	physical Block 1	design of learning environment	98	1
		time preference	63	2
		sound	56	3
		mobility	41	4
		light	36	5
		warmth	19	6
	affective Block 2	motivation	50	1
		locus of control	37	2
		persistence	34	3
		sensing/intuition	30	4
		thinking/feeling	27	5

(Table 7 continued)

Major Heading Cognitive	Element Affective Block 2	Subelement	Total Points	Rank
		tolerance of ambiguity	23	6
		anxiety levels	21	7
		responsibility	19	8
		judgment/perception	18	9
		extroversion/ introversion	13	10
		leader/follower	12	11
		proxemics	5	12
		empathy	5	12
		histrionics	4	14
		past/present/future orientation	2	15
	sociologi-cal Block 3	learns best in a varied mode	96	1
		learns best with peers	69	2

(Table 7 continued)

Major Heading Cognitive	Element sociological Block 3	Subelement	Total Points	Rank
		learns best alone	65	3
		learns best with authority figure	53	4
		learns best in mixed teams	51	5
		in a varied mode	96	1
	Sensory Orientation Block 4	auditory	64	2
		visual	63	3
		tactile	45	4
		kinesthetic	42	5
	inference modalities Block 5	field dependence/ independence	46	1
		abstract/concrete	35	2
		self direction/need for structure	28	3
		analytical/global	27	4

(Table 7 continued)

Major Heading Cognitive	Element inference modalities Block 5	Subelement	Total Points	Rank
		reflective/ impulsive	26	5
		analytical/ categorical/ inferential	22	6
		Verbal/Spatial preference	20	7
		serial/simultaneous	20	7
		focusing/scanning	17	9
		complexity/ simplicity	16	10
		leveling/sharpening	15	11
		random/sequential	14	12
		structure/looseness	14	12
technical	time needed to test(for most purposes) Block 1	30 min. or less	87	1
		45 min. or less	58	2

(Table 7 continued)

Major Heading	Element	Subelement	Total Points	Rank
technical	time needed to test(for most purposes) Block 1			
		60 min. or less	57	3
		15 min. or less	47	4
		time is unimportant	26	5
		2 hrs. or less	5	6
	test booklet Block 2	should be reuseable	123	1
		students should be able to write in it	68	2
		younger students-should be able to write in it	51	3
		older students-should be able to write in it	48	4
	total cost(Scoring,booklet,score sheets) Block 3	.25 or less a student	89	1

(Table 7 continued)

Major Heading technical	Element	Subelement	Total Points	Rank
	total cost(Scor-ing,book-let,score sheets) **Block 3**	.25 or less a student		
		cost is unimportant	85	2
		.26-.50 per pupil	42	3
		.76-1.00 per pupil	37	4
		.51-.75 per pupil	28	5
		1.01-2.00 per pupil	9	6
	manuals **Block 4**	should include an examiner's manual	114	1
		should have scoring key	74	2
		examiner's manual should have a bibliography	54	3
		should have follow up on how to get specific information on variables	39	4
		examiner's manual have graphs & charts	29	5

(Table 7 continued)

Major Heading technical	Element	Subelement	Total Points	Rank
	manuals should report Block 5	interpretation of scoring	65	1
		inventory reliability	58	2
		inventory validity	51	3
		norms	39	4
		development of inventory	36	5
		types of validity	31	6
		how, why, and which items are weighted	20	7
		meets all APA standards	10	8
	inventory adminis-tration procedure Block 6	mixed mode	173	1
		written	83	2
		oral	29	3

(Table 7 continued)

Major Heading technical	Element administration procedure Block 6	Subelement	Total Points	Rank
		visual(ex.pictures, charts, models, & graphs)	25	4
	scoring Block 7	both should be possible	266	1
		machine scored	28	2
		hand scored	16	3
	student response to inventory Block 8	mixed mode	157	1
		written	98	2
		visual	22	3
		oral	19	4
		movement(kinesthetic)	13	5

experts in this study. The top ranked subelement in each cognitive block was: Block 1 (physical element), design of the learning environment; Block 2 (affective element), motivation; Block 3 (sociological element), learns in a varied mode; Block 4 (sensory orientation), auditory; and Block 5 (inference modality), field dependence/independence. The top ranked subelement in each technical block was: Block 1 (time needed to test-for most purposes), 30 minutes or less; Block 2 (test booklet), should be reuseable; Block 3 (total cost-scoring, booklet, score sheets), 25 cents or less a student; Block 4 (manuals), should include an examiner's manual; Block 5 (manuals should report), interpretation of scoring; Block 6 (inventory administration procedure), mixed mode; Block 7 (scoring), should be able to hand and machine score; and Block 8 (student response to the inventory), should be able to respond in a mixed mode.

The experts were also asked to rank all the elements in the cognitive and technical categories. For each category they were given 10 points to distribute. They were to give the highest amount of points to the element they thought was the most important. They could give all the points to 1 element, the same amount of points to 2 or more elements, or "0" (zero) points to some elements. The highest number of points and the lowest rank indicated the element perceived as the most important element to be examined in the inventories by the experts in this study; conversely the lowest number of points and the highest rank indicated the element perceived as the least important to be examined in the inventories by the experts in this study. In Table 8 this data is summarized.

In the cognitive block the element perceived as the most important was inference modalities, and in the technical block the element perceived as the most important was inventory administration procedures. The element perceived as least important in the cognitive block was the physical element, and the element perceived as least important in the technical block was what the manuals should report. Under the cognitive elements the range of points was from 48 to 75, and under the technical elements the range was from 18 to 52.

ROUND 3

In Round 3, the experts were asked to look at the results from Round 2 and make any comments on the results. Twenty-eight experts participated in this Round. Table 9 summarizes the data. Experts either agreed without comment, agreed with comment, or disagreed on the results from Round 2. In addition to agreeing or disagreeing and commenting on the results of the specific elements, the experts were asked to agree or disagree and comment on the 2 broad categories of cognitive or technical.

Total agreement (agreement with and without comments) from the results of Round 2 ranged from 82.14% to 96.43%. There was most agreement (96.43%) on inventory administration procedures and scoring. There was least agreement (82.14%) on what materials should be in the manuals (scoring key,

Table 8

Ranking of Cognitive and Technical Elements

Major Heading	Element	Total Points	Rank
cognitive Block 1	inference modalities	75	1
	sensory orientation	64	2
	affective elements	63	3
	sociological elements	51	4
	physical elements	48	5
technical Block 2	inventory administration procedures	52	1
	manuals	49	2
	time needed to test	44	3
	test booklet	42	4
	student response to inventory	40	5
	scoring	31	6
	total cost	24	7
	manuals should report	18	8

Table 9

Convergence to Consensus: Cognitive and Technical Elements

Block	Category or Element	Agree Without Comment %	Agree With Comment %	Total Agree %	Disagree %
1	physical elements	67.8	17.86	85.71	14.29
2	affective elements	71.43	14.29	85.71	14.29
3	sociolog-ical elements	78.57	7.14	85.71	14.29
4	sensory orienta-tion	78.57	7.14	85.71	14.29
5	inference modalities	71.43	21.43	92.86	7.14
1	time needed to test	78.57	14.29	92.86	7.14
2	test booklet	82.14	10.71	92.86	7.14
3	total cost	75.00	14.29	89.29	10.71
4	manuals	71.43	10.71	82.14	17.86
5	manuals should report	75.00	14.29	89.29	10.71
6	inventory adminis-tration procedure	82.14	14.29	96.43	3.57

(Table 9 continued)

Block	Category or Element	Agree Without Comment %	Agree With Comment %	Total Agree %	Disagree %
7	scoring	85.71	10.71	96.43	3.57
8	student response to inventory	75.00	17.86	92.86	7.14
1	cognitive	85.71	7.14	92.86	7.14
2	technical	89.29	3.57	92.86	7.14

bibliography, information on variables, graphs, charts, and there should be an examiner's manual).

For every element at least 1 expert made comments. The percentage of experts that made comments ranged from 7.14% to 21.43%. Experts commented most on inference modalities, and the elements experts commented on least were sociological elements and sensory orientations. In the broad categories of cognitive and technical there was a total agreement (with and without comments) of 92.86%. The percentage of experts who made comments about the results from Round 2 on the cognitive category was 7.14%, and the percentage of experts who made comments about the results from Round 2 on the technical category was 3.57%

Question 4

Statement of Question

What is the perceived range of elements of cognitive/learning style inventories in terms of their respective importance?

Analysis of Data and Statement of Findings

ROUND 1

In Round 1 the experts were asked to generate a list of items they considered important characteristics of cognitive/learning style inventories.

Return Rate Round 1

Forty-one experts agreed to participate in the study. Thirty-six (87.8%) returned Round 1.

Response Rate

Of the 36 returns by the experts, 36 (100%) experts generated important characteristics of cognitive/learning style inventories.

Results Round 1

These are the responses the experts generated. They are listed in no specific order. The characteristics of cognitive/learning style inventories are:

1. Assessment tool for preferences,
2. A reporting of factors that influence a person's social interactions,
3. Assessment tool for attitudes,
4. Organized lists of elements necessary for the acquisition of a skill or completion of a task,
5. A series of questions designed to assess preferences of learners,
6. Perceptions,
7. Assessment tool for personality attributes,
8. A reporting of factors that influence affective behavior,

9. A series of processing tasks to assess learners' strengths and weaknesses,
10. A reporting of factors that influence an individual's achievement,
11. Assessment device that statistically represents the element(s) in learning,
12. A series of questions designed to assess learners' strengths and weaknesses,
13. Records of performance,
14. Records of preferences,
15. Records of behaviors,
16. Instruments used to group individuals,
17. Measuring device,
18. A form,
19. Test,
20. A systematic process of collecting data,
21. Defines personality,
22. Defines motivation constructs,
23. Self assessment,
24. Usually self reported,
25. Checklist of items,
26. Group administered,
27. Formats include checklists, paired comparisons, or scales,
28. Usually a paper and pencil activity,
29. Can be tactile,
30. Self perceptions,

31. Behavioral models possible,
32. Made of self reports or observations,
33. Can be oral,
34. Method of collecting information about learning styles in an informal way,
35. Instruments used to categorize individuals,
36. Instruments used to measure identified concepts and constructs,
37. Instruments which diagnose learning styles,
38. Survey of attitudes,
39. Survey of preferences,
40. Inexpensive,
41. Quick to use, and
42. Easy to use.

ROUND 2

Return Rate

Forty-one experts agreed to participate in the study. Thirty-three (80.5%) of the experts returned Round 2.

Response Rate

Of the 33 experts that returned Round 2, 33 (100%) ranked the characteristics of cognitive/learning style.

Results Round 2

The rankings as determined by the points the experts assigned each characteristic are summarized in Table 10. A

Table 10

Ranked List of Characteristics of Cognitive/Learning Style Inventories

Rank	Characteristic
1	instruments which diagnose learning styles
2	a series of questions designed to assess preferences of learners
3	assessment tool for preferences
4	a series of processing tasks to assess learners' strengths and weaknesses
5	survey of preferences
6	usually a paper and pencil activity
7	instruments used to measure identified concepts and constructs
8	assessment tool for personality attributes
9	measuring device
10	records of preferences
11	a reporting of factors that influence an individual's achievement
12	perceptions
13	assessment devise that statistically represents the element(s) in learning
14	a systematic process of collecting data

(Table 10 continued)

Rank	Characteristic
15	method of collecting information about learning styles in an informal way
16	usually self reported
17	instruments used to categorize individuals
18	self assessment
19	a series of questions designed to assess learners' strengths and weaknesses
20	tests
21	self perceptions
22	assessment tool for attitudes
23	organized lists of elements necessary for the acquisition of a skill or completion of a task
24	group administered
24	easy to use
26	inexpensive
27	records of performance
28	can be tactile
28	can be oral
28	quick to use

(Table 10 continued)

Rank	Characteristic
31	made of self reports or observations
32	checklist of items
33	a reporting of factors that influence a person's social interactions
34	a reporting of factors that influence affective behavior
35	formats include checklists, paired comparisons, or scales
36	instruments used to group individuals
37	defines motivation constructs
38	survey of attitudes
39	records of behaviors
40	a form
40	behavioral models possible
41	defines personality

ranking of 1 indicates the characteristic the experts, in this study, felt was the most important characteristic.

Ten or more points separated the 5 first ranked characteristics. The first 5 characteristics and the actual points assigned to them by the experts are: (1) instruments which diagnose learning styles, 101 points; (2) a series of questions designed to assess preferences of learners, 87 points; (3) assessment tool for preferences, 57 points; (4) a series of processing tasks to assess learners' strengths and weaknesses, 47 points; and (5) survey of preferences, 36 points. The characteristic ranked last by the experts, defines personality, only received 1 point.

ROUND 3

Return Rate

Forty-one experts agreed to participate in the study. In Round 3, 28 (69.29%) experts returned the survey.

Response Rate

Of the 28 experts that returned Round 3, 28 answered the question about characteristics of cognitive/learning style inventories.

Results Round 3

Convergence to Consensus

In Round 3 the experts were to asked to comment on the rankings from Round 2. The experts responded in this way: 85.71% agreed with the rankings without comment, 10.71% agreed with the rankings with comments, 96.42% agreed (with and without comments) with the rankings, and 3.57% disagreed with the rankings.

Question 5

Statement of Question

What elements are perceived as important for a model that assists practitioners in selecting an appropriate cognitive/learning style inventory?

Analysis of Data and Statement of Findings

ROUND 1

In Round 1 the experts were asked to generate two lists of items that would aid in the delineation of elements perceived as important for a model that assists practitioners in selecting an appropriate cognitive/learning style inventory. The first list generated by the experts was reasons to use cognitive/learning style inventories, and the second list generated by the experts was disappointments with cognitive/learning style inventories.

Return Rate

Forty-one experts agreed to participate in the study, and 36 (87.8%) experts returned Round 1.

Response Rate

For both lists in Round 1 all 36 (100%) experts who returned Round 1 generated items.

Results Round 1

List 1-Reasons to Use Cognitive/Learning Style Inventories

Below is the list of reasons to use cognitive/learning style inventories that was generated by the experts during Round 1. The list is in no specific order.

1. To predict learning,
2. To help make diagnosis,
3. To predict the success of independent study students,
4. To do research,
5. To determine the psychometric properties of the inventories,
6. To satisfy intellectual curiosity,
7. To pinpoint individual differences that correlate with student behaviors,
8. To supplement IQ tests,
9. To pinpoint individual differences that correlate with teacher behaviors,
10. To discriminate performance differences,

11. To assess children's skills,
12. To help college students learn how they learn,
13. To find out how learners perceive their achievements,
14. To help in the self actualization process,
15. To help college students learn about themselves,
16. To assess how learners' perceive their own behavior,
17. To assess how teachers' perceive their own behavior,
18. To teach teachers how to maximize their teaching,
19. To remind teachers of the diversity of any group of learners,
20. To help to ensure that learning occurs without gaps,
21. To aid in structuring educational augmentation programs,
22. To determine how to diversify learning materials,
23. To provide a framework to critique traditional teaching methods,
24. To personalize education,
25. To provide a framework for designing new teaching methods,
26. To get a historical view of how conditions affect learning preferences,
27. To find out if students' learning styles respond to teachers' teaching styles,
28. To investigate if developmental conditions affect learning preferences,
29. In order to investigate if different brain treatments enhance learning,
30. To check on the consistency of patterns among various

learning theories,

31. Because they are valid,
32. Because they are time efficient,
33. Because they are easy to administer,
34. Because they are reliable,
35. Because of the reasonable cost,
36. To help advisors work with individual students,
37. To determine learners' weaknesses,
38. To find the strengths of a majority of learners in a given situation,
39. To address learning problems,
40. To find ways to help students,
41. To help make student placements,
42. To determine cognitive style,
43. To determine a general picture of the learner, and
44. To help individuals in the learning process.

List 2-Disappointments with Cognitive/Learning Style Inventories

Below is the list of disappointments with cognitive/learning style inventories that was generated by the experts during Round 1. The list is in no specific order.

1. Not consistent,
2. Variations in different inventories of definitions of learning style,
3. Amount of overlap in different instruments,
4. Too simplistic,

5. Preference focus is superficial,
6. Measures too few variables,
7. Too general,
8. No information on how area being tested relates to other aspects of learning style,
9. Lack of cognitive measures for elementary students,
10. Not comprehensive,
11. Prescriptive nature of manuals,
12. No classroom application in manuals,
13. Skimpy manuals,
14. No manuals on some,
15. Lack of interpretation,
16. Poor direction on how to apply results to classroom,
17. Measures elements over which teachers have little or no control,
18. Conceptual orientation,
19. Misnomer-designed to measure ability not style,
20. Lack of direction for teachers on how to make choices about which instrument to use,
21. No theoretical base,
22. Poor development,
23. Lack of information on the development of the inventory,
24. Ignores findings of experimental psychology,
25. Lack of empirical evidence,
26. Lacks a thorough grounding in experimental psychology,
27. Not well researched,
28. Lack of variability in administration procedures,

29. Many need to be sent out to be scored,
30. The use mainly of a checklist,
31. Too cumbersome,
32. Self reporting among children is unreliable,
33. Reassessment too time consuming,
34. Time to administer,
35. Scoring is difficult,
36. Ipsative scoring scales,
37. Too few items in each category,
38. Too much self reporting,
39. Honesty of self reporting,
40. Difficulty of monitoring group testing,
41. Too expensive,
42. Lack of documentation of effectiveness of inventory,
43. Lack of validity,
44. Too high of a correlation with measures of IQ,
45. Lack of reliability,
46. Leads to unwarranted conclusions because of lack of validity,
47. Measures for primary children ineffective,
48. Poor norming,
49. Not enough consistency across dimensions, and
50. Lack of norms for the handicapped.

ROUND 2

In Round 2, the experts were asked to rank both lists. In each list a ranking of 1 indicated the item the experts in this study considered most important.

Return Rate

Forty-one experts agreed to participate in the study. Thirty-three (80.5%) of the experts returned Round 2.

Response Rate

For both lists in Round 2, all 33 (100%) experts who returned Round 2 generated items.

Results Round 2

List 1-Reasons to Use Cognitive/Learning Style Inventories

The rankings, as determined by the points the experts assigned for the reasons to use cognitive/learning style inventories, are summarized in Table 11. A ranking of 1 indicated the reason to use the inventory the experts felt was the most important.

The reason that the experts ranked first, to help individuals in the learning process received 83 actual points from the experts. The second ranked reason, to do research, only received 49 actual points. Reasons that ranked third (to provide a framework for designing new teaching methods and to find out if students' learning styles responded to teachers' teaching styles) received 44 points. One reason to use cognitive/learning style inventories only received 1 point from the experts in Round 2. It was, to check on the

Table 11

Ranked List of Reasons to Use Cognitive/Learning Style Inventories

Rank	Reason To Use
1	to help individuals in the learning process
2	to do research
3	to provide a framework for designing new teaching methods
3	to find out if students' learning styles respond to teachers' teaching styles
5	to determine how to diversify learning materials
5	to determine cognitive style
7	to determine learners' strengths
7	to pinpoint individual differences that correlate with student behaviors
9	to teach teachers how to maximize their teaching
10	to address learning problems
10	to predict learning
12	to pinpoint individual differences that correlate with teacher behaviors
13	to personalize education
14	to determine learners' weaknesses
15	to find ways to help students

(Tab

Rank
16
17
18
19
20
21
22
22
24
24
26
27
27
29
30
30

(Table 11 continued)

Rank	Reason To Use
16	to help make diagnosis
17	to help college students learn how they learn
18	to determine a general picture of the learner
19	to remind teachers of the diversity of any group of learners
20	to aid in structuring educational augmentation programs
21	to help in the self actualization process
22	to assess how learner' perceive their own behavior
22	to provide a framework to critique traditional teaching methods
24	to help advisors work with individual students
24	to determine the psychometric properties of the inventories
26	to satisfy intellectual curiosity
27	to find the strengths of a majority of learners in a given situation
27	to investigate if developmental conditions affect learning preferences
29	to supplement IQ tests
30	to discriminate performance differences
30	to assess how teachers' perceive their own behavior

(Table 11 continued)

Rank	Reason To Use
32	to predict the success of independent study students
32	to assess children's skills
34	to help ensure that learning occurs without gaps
35	in order to investigate if different brain treatments enhance learning
36	to help college students learn about themselves
36	because they are valid
38	to help make student placements
39	to check on the consistency of patterns among various learning theories

consistency of patterns among various learning theories. Some reasons to use the inventories received "0" (zero) points in Round 2. They were: (1)to find out how learners' perceive their achievements, (2)because they are time efficient, (3)because they are easy to administer, (4)because they are reliable, (5)because of the reasonable cost, and (6)to get a historical view of how learning conditions affect learning preferences.

List Two-Disappointment with Cognitive/Learning Style Inventories

The rankings as determined by the points the experts assigned for the disappointments with cognitive/learning style inventories are summarized in Table 12. A ranking of 1 indicated the greatest disappointment that the experts had with the inventories of cognitive/learning style. There were 48 disappointments with inventories of cognitive/learning style that the experts identified and gave points to in Round 2 of the Delphi. There were 2 additional disappointments with cognitive/learning style inventories that were identified in Round 1 but received "0" (zero) points in Round 2. The 2 disappointments with the inventories of cognitive/ learning style that received "0" (zero) points were conceptual orientation and time to administer. The major disappointment with the inventories was the variations in different inventories of definitions of style. This disappointment with the inventory received 84 actual points from the experts, whereas, the second greatest

Table 12

Ranked List of Disappointments With Cognitive/Learning Style Inventories

Rank	Disappointments with Style Inventories
1	variations in different inventories of definitions of learning style
2	lack of validity
3	poor direction on how to apply results to classroom
4	lack of reliability
5	too simplistic
6	no classroom application in manuals
6	measures elements over which teachers have little or no control
8	lack of cognitive measures for elementary students
9	leads to unwarranted conclusions because of lack of validity
10	lack of empirical evidence
11	preference focus is superficial
12	no information on how area being tested relates to other aspects of learning style
13	not well researched
14	lack of documentation of effectiveness of inventory

(Table 12 continued)

Rank	Disappointments with Style Inventories
15	lacks a through grounding in experimental psychology
15	poor norming
15	lack of norms for the handicapped
18	no theoretical base
18	lack of information on development of inventory
20	lack of interpretation
21	not consistent
21	skimpy manuals
21	measures for primary children ineffective
24	no manuals on some
24	too much self reporting
24	honesty of self reporting
27	self reporting among children is unreliable
27	scoring is difficult
29	lack of direction for teachers on how to make choices about which instrument to use
30	too few items in each category

(Table 12 continued)

Rank	Disappointments with Style Inventories
31	many need to be sent out to be scored
32	prescriptive nature of manuals
32	poor development
32	too expensive
35	too high of correlation with measures of IQ
36	reassessment too time consuming
37	measures too few variables
37	too general
37	ignores findings of experimental psychology
37	not enough consistency across dimensions
41	the use mainly of a checklist
42	not comprehensive
43	misnomer-designed to measure ability not style
44	ipsative scoring scales
45	too cumbersome
46	difficulty of monitoring group testing

(Table 12 continued)

Rank	Disappointments with Style Inventories
47	amount of overlap in different instruments
47	lack of variability in administration procedures

disappointment with the inventories (lack of validity) received 46 actual points. There were 2 disappointments with the inventories that only received 1 actual point. They were the amount of overlap in different instruments and the lack of variability in administration procedures.

ROUND 3

Return Rate

Forty-one experts agreed to participate in the study. In Round 3, 28 (69.29%) experts returned the survey.

Response Rate

Of the 28 experts that returned Round 3, 28 (100%) answered the questions about reasons to use and disappointments with cognitive/learning style inventories.

Results Round 3

Convergence to Consensus

<u>List 1</u>-Reasons to Use Cognitive/Learning Style Inventories

In Round 3 the experts were asked to comment on the rankings from Round 2. The experts responded in this way: 78.57% agreed with the rankings without comment, 10.71% agreed with the rankings with comments, 89.29% agreed (with and without comments) with the rankings, and 10.71% disagreed with the rankings.

List 2-Disappointments with Cognitive/Learning Style Inventories

In Round 3 the experts were asked to comment on the rankings from Round 2. The experts responded in this way: 78.57% agreed with the rankings without comment, 10.71% agreed with the rankings with comments, 89.29% agreed (with and without comments) with the rankings, and 10.71% disagreed with the rankings.

SUMMARY OF FINDINGS ACROSS ALL QUESTIONS

Question 1

Which cognitive/learning style inventories are perceived as being widely used?

The experts generated a list of 30 inventories they had used and/or were familiar with from 1970 through 1990. The list of inventories below include responses of experts who have actually administered the inventories, and also included are responses of experts who are very familiar with the inventories, but have never administered them. This is a ranked list going from most used and familiar to least used and familiar.

Dunn, Dunn & Price-Learning Style Inventory*
Kolb-Learning Style Inventory
Myer & Briggs-Myer-Briggs Type Indicator

Witkin-Embedded Figures Test

*Indicates that the inventories within that cluster received the same rank of usage and familiarization by the experts.

Witkin-Group Embedded Figures Test

Canfield-Learning Style Inventory*
Kagan-Matching Familiar Figures Test

Hill-Cognitive Style Interest Inventory*
Keefe-NASSP Learning Style Profile

Torrance-Your Style of Learning & Thinking

Gregorc-Transaction Ability Inventory

Letteri-Cognitive Profile*
Renzulli & Smith-Learning Style Inventory

French, Ekstrom & Price-Hidden Figures Test

Reinert-Edmonds-Edmonds Learning Style Identification* Exercise
Schmeck-Inventory of Learning Processes
Sigel-Test of Conceptual Style

Barbe/Swassing-Barbe/Swassing Modality Kit

Papalia-Learning Style Modalities

McCarthy-4MAT Inventory*
Witkin-Children's Embedded Figures Test

Brown & Cooper*
Coscarelli & Stonewater-Decision Making Inventory
Grasha & Riechman-Student Learning Style
Hunt-Conceptual Level
Lowentral-Visual/Haptic
Malcolm et.al.-Learning Style Identification Scale
Murdock-Teaching Center Learning Style Inventory

The inventories the experts used in order of the most used to the least used are listed below:

Witkin-Group Embedded Figures Test

Kolb-Learning Style Inventory

Myer & Briggs-Myer-Briggs Type Indicator*
Witkin-Embedded Figures Test

Canfield-Learning Style Inventory*
Kagan-Matching Familiar Figures Test

*Indicates that the inventories within that cluster received the same rank of usage and familiarization by the experts.

Keefe-NASSP Learning Style Profile*
Torrance-Your Style of Learning & Thinking

French, Ekstrom & Price-Hidden Figures Test*
Gregorc-Transaction Ability Inventory

Hill-Cognitive Style Interest Inventory

Letteri-Cognitive Profiles

Reinert-Edmonds-Edmonds Learning Style Identification Exercise*
Renzulli & Smith-Learning Style Inventory
Sigel-Test of Conceptual Style

Barbe/Swassing-Barbe/Swassing Modality Kit*
Witkin-Children's Embedded Figures Test

Brown & Cooper*
Hunt-Conceptual Level
Murdock-Teaching Center Learning Style Inventory

The experts used the inventories with preschoolers through adults. However, most of the inventories were used with adults. Only one inventory (Kagan's Matching Familiar Figures Test) was used by two experts for preschoolers. Nine inventories were used with elementary school (grades K-5) students, 14 inventories were used with middle school(grades 6-8) students, 14 inventories were used with high school (grades 9-12) students, and 17 inventories were used with adults (people who were out of school or in institutions of higher learning).

*Indicates that the inventories within that cluster received the same rank of usage by the experts.

Question 2

Which elements of cognitive/learning style inventories are perceived to differentiate effectively and efficiently among widely used inventories?

This researcher using a literature review to generate questions and the experts in this study was able to generate a list of elements in the cognitive and technical dimensions that the experts felt differentiated effectively and efficiently among widely used inventories. In the cognitive dimension, physical elements, affective elements, sociological elements, sensory orientations, and inference modalities and their subelements were identified. In the technical domain, time needed to test, test booklets, total cost, manuals, manuals should report, inventory administration procedures, scoring, and student response to the inventory and their subelements were identified. This list formed the basis for the ranking of the elements to determine their respective importance for Question 3.

Question 3

Are some elements in widely used cognitive/learning style inventories perceived as more important than other elements?

Table 13 is a summary of the combined lists of categories and elements in both the cognitive and technical

Table 13

Rankings of Categories and Elements of Cognitive/Learning Style Inventories

COGNITIVE

RANK	CATEGORY		
1	Inference Modalities		
		RANK	ELEMENT
		1	field dependence/independence
		2	abstract/concrete
		3	self direction/need for structure
		4	analytical/global
		5	reflective/impulsive
		6	analytical/categorical/inferential
		7	verbal spatial preference
		8	serial/simultaneous
		9	focusing/scanning
		10	complexity/simplicity
		11	leveling/sharpening
		12	random/sequential
		13	structure/looseness

RANK	CATEGORY		
2	Sensory Orientations		
		RANK	ELEMENT
		1	in a varied mode
		2	auditory
		3	visual
		4	tactile
		5	kinesthetic

RANK	CATEGORY		
3	Affective Elements		
		RANK	ELEMENT
		1	motivation
		2	locus of control
		3	persistence
		4	sensing/intuition
		5	thinking/feeling
		6	tolerance of ambiguity
		7	anxiety levels
		8	responsibility
		9	judgment/perception
		10	extroversion/introversion
		11	leader/follower
		12	proxemics
		12	empathy
		14	histrionics
		15	past/present/future orientation

(Table 13 continued)

RANK		CATEGORY
4		Sociological Elements: learns best
	RANK	ELEMENT
	1	in a varied mode
	2	with peers
	3	alone
	4	with authority figure
	5	in mixed teams

RANK		CATEGORY
5		Physical Elements
	RANK	ELEMENT
	1	design of learning environment
	2	time preference
	3	sound
	4	mobility
	5	light
	6	warmth

TECHNICAL

RANK		CATEGORY
1		Inventory Administration Procedures
	RANK	ELEMENT
	1	mixed mode
	2	written
	3	oral
	4	visual (ex. pictures, charts, models, & graphs)
RANK		CATEGORY
2		Manuals
	RANK	ELEMENT
	1	should include an examiner's manual
	2	should have a scoring key
	3	examiner's manual should have bibliography
	4	should have follow up on how to get specific information on variables
	5	examiner's manual should have graphs and charts

RANK		CATEGORY
3		Time Needed to Test
	RANK	ELEMENT
	1	30 min. or less
	2	15 min. or less
	3	45 min. or less
	4	60 min. or less
	5	time is unimportant
	6	2 hours or less

(Table 13 continued)

RANK		CATEGORY
4		Test Booklet
	RANK	ELEMENT
	1	should be reuseable
	2	students should be able to write in it
	3	younger students-should be able to write in it
	4	older students-should be reuseable
RANK		CATEGORY
5		Student Response to Inventory
	RANK	ELEMENT
	1	mixed mode
	2	written
	3	visual
	4	oral
	5	movement (kinesthetic)
RANK		CATEGORY
6		Scoring
	RANK	ELEMENT
	1	both should be possible (hand & machine)
	2	machine scored
	3	hand scored
RANK		CATEGORY
7		Total Cost
	RANK	ELEMENT
	1	.25 or less per pupil
	2	cost is unimportant
	3	.26-.50 per pupil
	4	.51-.75 per pupil
	5	.76-1.00 per pupil
RANK		CATEGORY
8		Manuals Should Report
	RANK	ELEMENT
	1	interpretation of scoring
	2	inventory reliability
	3	inventory validity
	4	norms
RANK		CATEGORY-continued
8		Manuals Should Report
	RANK	
	5	development of inventory
	6	types of validity
	7	how, why, and which items are weighted
	8	how it meets all APA standards

domains. This is a ranked list. In Round 3, the experts were asked to comment on the ranks listed in Table 13. Categories of "Agree Without Comments", "Agree With Comments", "Total Agree" (with and without comments), and "Disagree" were constructed from these comments. Table 14 summarizes highest and lowest agreement across all elements in each category.

Total agreement by the experts (with and without comments ranged from 82.14% to 96.43%. The amount of comments that the experts made ranged from 3.57% to 21.43%.

Table 15 presents the means, medians, and modes of the percentages across all elements in each category of agreement without comment, agreements with comment total agreement (with and without comment), and disagreements.

The mean of total agreement (with and without comments) by the experts was 90.24%. The median of total agreement (with and without comments) by the experts was 92.86%. The mode of total agreement (with and without comments) by the experts was 92.86.

Question 4

What is the perceived range of elements of cognitive/learning style inventories in terms of their respective importance?

In Round 1, the experts were asked to generate a list of important characteristics of cognitive/learning style

Table 14

Agreement Across all Elements in Round 3 Convergence to Consensus of Cognitive/Learning Style Inventories

Category	Highest %	Lowest %
Agree Without Comment	89.29	67.8
Agree With Comment	21.43	3.57
Total Agree (with and without comment)	96.43	82.14
Disagree	17.86	3.57

Table 15

Percentage Mean, Median, and Mode of Agreement Across All Elements In Round 3 Convergence to Consensus

Agreement	%Mean	%Median	%Mode
Agree Without Comment	77.85	75.0	71.43 75.0 78.57
Agree With Comment	12.38	14.29	14.29
Total Agree (With And Without Comment)	90.24	92.86	92.86
Disagree	9.76	7.14	7.14

inventories. A list of 42 items were generated by the experts. In Round 2, the experts ranked these items in terms of their respective importance. Table 16 summarizes these ranks and divides the ranks of the characteristics into interquartile ranges. Because there are not exact quarters, in quartile 1 and 3 there are 10 characteristics and in quartile 2 and 4 there are 11 characteristics (Weiss & Hassett 1982,72).

In quartile 1 the characteristics that the experts ranked 1 through 5 in their ranked order are: (1)instruments which diagnose learning style, (2)a series of questions designed to assess preferences of learners, (3)assessment tool for preferences, (4)a series of processing tasks to assess learners' strengths and weaknesses, and (5)survey of preferences. The characteristics that were ranked 1 through 4 by the experts were separated by 10 or more points from one another.

Convergence to Consensus

In Round 3, the experts were asked to comment on the rankings from Round 2. The experts responded in this way: 85.71% agreed with the rankings without comment, 10.71% agreed with the rankings with comments, 96.42% (with and without comments) agreed with the rankings, and 3.57% disagreed with the rankings.

Table 16

Inter-Quartile Ranges and Ranks of Characteristics of Cognitive/Learning Style Inventories

QUARTILE ONE (Q1)

Rank	Characteristic
1	instruments which diagnose learning styles
2	a series of questions designed to assess preferences of learners
3	assessment tool for preferences
4	a series of processing tasks to assess learners' strengths and weaknesses
5	survey of preferences
6	usually a paper and pencil activity
7	instruments used to measure identified concepts and constructs
8	assessment tool for personality attributes
9	measuring device
10	records of preferences

QUARTILE TWO (Q2)

11	a reporting of factors that influence an individual's achievement

(Table 16 continued)

Rank	Characteristic
12	perceptions
13	assessment device that statistically represents the element(s) in learning
14	a systematic process of collecting data
15	method of collecting information about learning styles in an informal way
16	usually self reported
17	instruments used to categorize individuals
18	self assessment
19	a series of questions designed to assess learners' strengths and weaknesses
20	tests
21	self perceptions
	QUARTILE THREE (Q3)
22	assessment tool for attitudes
23	organized lists of elements necessary for the acquisition of a skill or completion of a task
24	group administered
24	easy to use

(Table 16 continued)

Rank	Characteristic
26	inexpensive
27	records of performance
28	can be tactile
28	can be oral
28	quick to use
31	made of self reports or observations
	QUARTILE FOUR (Q4)
32	checklist of items
33	a reporting of factors that influence a person's social interactions
34	a reporting of factors that influence affective behavior
35	formats include checklists, paired comparisons, or scales
36	instruments used to group individuals
37	defines motivation constructs
38	survey of attitudes
39	records of behaviors

(Table 16 continued)

Rank	Characteristic
40	a form
40	behavioral models possible
41	defines personality

Question 5

What elements are perceived as important for a model that assists practitioners in selecting an appropriate cognitive/learning style inventory?

In Round 1, the experts were asked to generate 2 lists that defined the elements that they perceived as important for a model that would assist practitioners in selecting an appropriate cognitive/learning style inventory. The first list that the experts generated was the reasons to use cognitive/learning style inventories. The second list they generated was the disappointments with cognitive/learning style inventories. A list of 45 items was generated by the experts for reasons to use cognitive/learning style inventories, and a list of 50 items was generated by the experts for disappointments with cognitive/learning style inventories. However, when the experts assigned points to these lists in Round 2 some elements received "0" (zero) points and were dropped from the lists. In Round 2 the experts ranked these items in terms of their respective importance. Table 17 summarizes the ranks for reasons to use cognitive/learning style inventories and divides the ranks of the reasons into interquartile ranges. Because there are not exact quarters, in quartiles 2, 3, and 4 there are 10 reasons, and in quartile 1 there are 9 reasons (Weiss & Hassett 1982,72).

The reason that the experts ranked first in reasons to

Table 17

Interquartile Ranges and Ranks of Reasons to Use Cognitive/Learning Style Inventories

QUARTILE ONE (Q1)

Rank	Reason To Use
1	to help individuals in the learning process
2	to do research
3	to provide a framework for designing new teaching methods
3	to find out if students' learning styles respond to teachers' teaching styles
5	to determine how to diversify learning materials
5	to determine cognitive style
7	to determine learners' strengths
7	to pinpoint individual differences that correlate with student behaviors
9	to teach teachers how to maximize their teaching

QUARTILE TWO (Q2)

10	to address learning problems

(Table 17 continued)

Rank	Reason To Use
10	to predict learning
12	to pinpoint individual differences that correlate with teacher behaviors
13	to personalize education
14	to determine learners' weaknesses
15	to find ways to help students
16	to help make diagnosis
17	to help college students learn how they learn
18	to determine a general picture of the learner
19	to remind teachers of the diversity of any group of learners

QUARTILE THREE (Q3)

20	to aid in structuring educational augmentation programs
21	to help in the self actualization process
22	to assess how learner' perceive their own behavior
22	to provide a framework to critique traditional teaching methods
24	to help advisors work with individual students

(Table 17 continued)

Rank	Reason To Use
24	to determine the psychometric properties of the inventories
26	to satisfy intellectual curiosity
27	to find the strengths of a majority of learners in a given situation
27	to investigate if developmental conditions affect learning preferences
29	to supplement IQ tests

QUARTILE FOUR (Q4)

30	to discriminate performance differences
30	to assess how teachers' perceive their own behavior
32	to predict the success of independent study students
32	to assess children's skills
34	to help ensure that learning occurs without gaps
35	in order to investigate if different brain treatments enhance learning
36	to help college students learn about themselves
36	because they are valid
38	to help make student placements
39	to check on the consistency of patterns among various learning theories

use inventories of cognitive/learning style received 34 points (actual points that the experts assigned on which the rankings were built) more than the next reason to use the inventories. The first 5 reasons to use the inventories determined by the experts in quartile 1 were: (1)to help individuals in the learning process, (2)to do research, (3)to provide a framework for designing new teaching methods, (4)to find out if students' learning styles respond to teachers' teaching styles, and (5)to determine how to diversify learning materials.

Table 18 summarizes the ranks for disappointments with cognitive/learning style inventories and divides the ranks of the disappointments with into interquartile ranges. Because of ties in the ranks, there are not exact quarters: in quartiles 1 and 4 there are 12 disappointments, in quartile 2 there is 14 disappointments, and in quartile 3 there is 10 disappointments (Weiss & Hassett 1982,72). In quartile 1 the experts ranked these 5 disappointments first: (1)variations in different inventories of definitions of learning style, (2)lack of validity, (3)poor direction on how to apply results to classroom, (4)lack of reliability, and (5)too simplistic.

Variations in different inventories of definitions of learning style, which was ranked first, was given 84 actual points by the experts which was 38 points higher than the second ranked disappointment.

Table 18

Interquartile Ranges and Ranks of Disappointments With Cognitive/Learning Style Inventories

QUARTILE ONE (Q1)

Rank	Disappointments with Style Inventories
1	variations in different inventories of definitions of learning style
2	lack of validity
3	poor direction on how to apply results to classroom
4	lack of reliability
5	too simplistic
6	no classroom application in manuals
6	measures elements which teachers have little or no control
8	lack of cognitive measures for elementary students
9	leads to unwarranted conclusions because of lack of validity
10	lack of empirical evidence
11	preference focus is superficial
12	no information on how area being tested relates to other aspects of learning style

(Table 18 continued)

QUARTILE TWO (Q2)

Rank	Disappointments with Style Inventories
13	not well researched
14	lack of documentation of effectiveness of inventory
15	lacks a through grounding in experimental psychology
15	poor norming
15	lack of norms for the handicapped
18	no theoretical base
18	lack of information on development of inventory
20	lack of interpretation
21	not consistent
21	skimpy manuals
21	measures for primary children ineffective
24	no manuals on some
24	too much self reporting
24	honesty of self reporting

(Table 18 continued)

QUARTILE THREE (Q3)

Rank	Disappointments with Style Inventories
27	self reporting among children is unreliable
27	scoring is difficult
29	lack of direction for teachers on how to make choices about which instrument to use
30	too few items in each category
31	many need to be sent out to be scored
32	prescriptive nature of manuals
32	poor development
32	too expensive
35	too high of correlation with measures of IQ
36	reassessment too time consuming

QUARTILE FOUR (Q4)

37	measures too few variables
37	too general

(Table 18 continued)

Rank	Disappointments with Style Inventories
37	ignores findings of experimental psychology
37	not enough consistency across dimensions
41	the use mainly of a checklist
42	not comprehensive
43	misnomer-designed to measure ability not style
44	ipsative scoring scales
45	too cumbersome
46	difficulty of monitoring group testing
47	amount of overlap in different instruments
47	lack of variability in administration procedures

Convergence to Consensus

In Round 3 the experts were asked to comment on the rankings of Round 2 to determine if the experts agreed or disagreed with the rankings from Round 3. Four categories were built from these comments. They were: Agree Without Comment, Agree With Comment, Total Agree (With and Without Comment, and Disagree. Table 19 summarizes the convergence to consensus for reasons to use and disappointments with inventories of learning/cognitive style.

In all the categories of convergence to consensus both reasons to use inventories of cognitive/learning style and disappointments with inventories of cognitive/learning style had the same consensus as determined by the experts in this study. In the category of total agreement (with and without comments), there was 89.29% agreement with the rankings of Round 2, and 10.71% of the experts commented on the rankings.

SUMMARY

In this chapter the researcher stated the 5 research questions. For each research question there was an analysis of data and statement of findings. Additionally the researcher stated the summary of findings across all the questions. Finally a summary of the chapter was presented.

Table 19

Convergence to Consensus Round 3 For Reasons to Use and Disappointments with Inventories of Cognitive/Learning Style

	%Reasons To Use	%Disappointments With
Agree Without Comment	78.57	78.57
Agree With Comment	10.71	10.71
Total Agree (With And Without Comment)	89.29	89.29
Disagree	10.71	10.71

List of Findings

Question 1

Which cognitive/learning style inventories are perceived as being widely used?

In Round 1, 30 inventories were identified by the experts as inventories that they had used or with which they were familiar.

Question 2

Which elements of cognitive/learning style inventories are perceived to differentiate effectively and efficiently among widely used inventories?

In Round 1 a list of elements perceived to differentiate effectively and efficiently among widely used inventories was developed. In the cognitive dimension there were physical elements, affective elements, sociological elements, sensory orientations, and inference modalities. In the technical dimension there was time needed to test, cost, manuals, manuals should report, inventory administration procedures, scoring, and student responses to the inventory.

Question 3

Are some elements in widely used cognitive/learning style inventories perceived as more important than other elements?

In Round 2, the experts were asked to give points for the elements they had developed for Question 2. A ranking from points given by the experts was established. In Round 3, convergence to consensus, across all the elements a 90.24% agreement was reached.

Question 4

What is the perceived range of elements of cognitive/learning style inventories in terms of their respective importance?

In Round 1, 42 elements or characteristics of cognitive/learning style inventories were developed by the experts,and in Round 2 the experts ranked these characteristics. During Round 3, the experts were asked to comment on the rankings, and from these rankings agreement or disagreement (convergence to consensus) was constructed. There was a 96.42% agreement reached with the rankings and a 3.57% disagreement reached with the rankings by the experts.

Question 5

What elements are perceived as important for a model that assists practitioners in selecting an appropriate cognitive/learning style inventory?

In Round 1, the experts were asked to generate 2 lists that defined the elements that they perceived as important for a model that would assist practitioner in selecting an appropriate cognitive/learning style inventory. The first list that the experts generated was the reasons to use cognitive/learning style inventories. The second list they generated was the disappointments with cognitive/learning style inventories. In Round 2 the experts assigned points from which rankings were built for each of the lists. There were 39 reasons to use cognitive/learning style inventories ranked and 48 disappointments with cognitive/learning style ranked. In Round 3 the experts were asked to comment on the rankings and from those comments agreement or disagreement (convergence to consensus) was ascertained. For both reasons to use cognitive/learning style inventories and disappointments with cognitive/learning style inventories, there was 89.29% agreement with the rankings and 10.71% disagreement with the rankings.

A MODEL FOR EVALUATING AND CHOOSING AMONG
WIDELY USED ASSESSMENT INVENTORIES
OF COGNITIVE/LEARNING STYLE:
AN EXPLORATORY DELPHI STUDY

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CHAPTER 5

SUMMARY, CONCLUSIONS, RECOMMENDATIONS, AND REFLECTIONS

INTRODUCTION

This concluding chapter contains 5 major sections: (1) a summary of the study (2) presentation of findings, conclusions and research recommendations by question, (3) a model for evaluating and choosing among widely used assessment inventories of cognitive/learning style, (4) reflections, and (5) a summary of Chapter 5.

SUMMARY OF THE STUDY

Very little research has been done which evaluates, compares, and contrasts inventories of cognitive/learning style. Because these inventories are so different from each other, practitioners often have a difficult time choosing among the different inventories to find one that meets their instructional needs.

The purpose of this research was to provide new insights about and add to the existing body of knowledge on cognitive/learning style assessment inventories. Additionally, using results from a Delphi Study conducted with experts in the field of cognitive/learning style assessment inventories, a model was built to aid practitioners in selecting an inventory to meet their instructional needs.

Three relevant areas of the literature were reviewed. The first area of the literature review for this study examined the Delphi technique which was the methodology of this research. It described the technique as a group process which employs written responses instead of bringing groups of people together. Also the question of suitability and validity of this methodology is addressed. The Delphi methodology is explained in more detail in Chapter 3, Design of the Study.

The second area of the literature that was reviewed was cognitive/learning style. The definition of learning style developed by Keefe and Languis (1985) was the one used in this study.

> ...the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment. It is demonstrated in that pattern of behavior and performance by which an individual approaches educational experiences. Its basis lies in the structure of neural organization and personality which both molds and is molded by human development and the learning experiences of home, school, and society (p. 140).

Finally, research on cognitive/learning style inventories formed the third area of review for this study. The review of the literature in this area indicated that research was fragmented and limited.

The research questions in this study are:

1. Which cognitive/learning style inventories are perceived as being widely used?
2. What elements of cognitive/learning style inventories are perceived to differentiate effectively and efficiently among widely used inventories?
3. Are some elements in widely used cognitive/learning style inventories perceived as more important than other elements?
4. What is the perceived range of elements of cognitive/learning style inventories in terms of their respective importance?
5. What elements are perceived as important for a model that assists practitioners in selecting an appropriate cognitive/learning style inventory?

The sample for this study consisted of 41 experts in the field of cognitive/learning style inventories who had written about, researched, and used the inventories. Three rounds of the Delphi survey were sent to these experts. The first round of questions was developed by this researcher using a literature review. Subsequent rounds were developed by using the responses from the previous round. The third round brought convergence to consensus.

Chapter 4 described the results from the data analysis. This chapter addressed the 5 research questions. Tables were presented to support the data. The experts reached consensus on each question which ranged from 82.14% to 96.42%. After each question results were discussed.

RESULTS, CONCLUSIONS, AND RECOMMENDATIONS BY QUESTION

Question 1

Statement of Question 1

Which cognitive/learning style inventories are perceived as being widely used?

Results, Conclusions and Recommendations for Question 1

Result 1

In Round 1, 30 inventories were identified by the experts as inventories that they had used or with which they were familiar. Below are listed the top 7 inventories chosen by the experts in this study as the most used inventories. They are in the order of their use.

1. Witkin-Group Embedded Figures Test
2. Kolb-Learning Style Inventory
3. Dunn, Dunn, & Price-Learning Style Inventory
4. Myer & Briggs-Myer-Briggs Type Indicator
5. Witkin-Embedded Figures Test
6. Canfield-Learning Style Inventory
7. Kagan-Matching Familiar Figures Test

There were 30 inventories perceived as being widely used. All are published inventories.

Conclusion 1

Less than one half of the published inventories are perceived by the experts in this study as being widely used.

Research Recommendation 1

Published inventories need to be examined to see why certain inventories are being used and others are not being used. In addition, research needs to be done to investigate "in house" unpublished inventories in relationship to how many are being used, for what purposes they are being used, and why they are being used instead of published inventories.

Result 2

Some inventories are used more often than other inventories.

Conclusion 2

Inventories that are written about in professional magazines and in trade magazines are used by the experts and practitioners more often than inventories that do not have extensive written exposure.

Research Recommendation 2

Research needs to be done to explore if those inventories that have extensive written exposure are really better instruments than those instruments that do not have the exposure. Research also needs to be done to inquire why certain instruments receive written exposure and others do not.

Result 3

Inventories are used more with adults than children, more with older children than younger children, and almost never with preschoolers.

Conclusions 3

Most cognitive/learning style inventories are predicated on the assumption that the people with whom they are being used can read, and thus eliminates the nonreading population which includes preschoolers and young children as well as adults that are illiterate. In this study, the experts were college professors whose main clientele are adult learners, and the results could reflect this bias.

Research Recommendation 3

Research needs to be done to investigate if it is important to know and test for the cognitive/learning style of preschoolers, young children and illiterate adults. This study needs to be replicated with a wider sample including experts outside of the university system and practitioners in the public school system to see if these tests are really being used with mainly older students (middle and high school students) and adults.

Result 4

Inventories have been used for over 20 years, and are still being used presently.

Conclusion 4

Most of the inventories of cognitive/learning style were developed and published between 1971 and 1981 and have not been revised.

Research Recommendation 4

Research needs to be done to see if inventories that are 10 years old or older are still relevant in terms of format, content, administration procedures, and scoring. There needs to be some investigation why older inventories are not being updated, and why there are so few new inventories.

Question 2

Statement of Question 2

What elements of cognitive/learning style inventories are perceived to differentiate effectively and efficiently among widely used inventories?

Results, Conclusions, and Recommendations for Question 2

Result 1

Using a literature review and input from the experts, a list of elements that were perceived to differentiate effectively and efficiently among widely used inventories was developed. This list included: physical elements, affective elements, sociological elements, sensory orientations, inference modalities, time needed to test, test booklets, total cost, manuals, what manuals should report, inventory administration procedures, scoring, and student response to the inventories.

Conclusion 1

There are no published inventories that include all 83 elements selected by the experts. It is likely that an instrument that would measure all 83 elements would be too time consuming to administer for most purposes.

Research Recommendation 1

Research needs to be done to see how many and what elements are measured by each widely used inventory of cognitive/learning style, and the results should be published in a single list so that practitioners could use the list to make decisions about what inventories they want to use.

Question 3

Statement of Question 3

Are some elements in widely used cognitive/learning style inventories perceived as more important than other elements?

Results, Conclusions, and Recommendations for Question 3

Result 1

In Round 2 of the Delphi, the experts ranked the elements from question 2 to determine their importance. The experts were able to assign points from most important to least important to elements identified in Round 1 in order to determine the importance of those elements. In Round 3, consensus on the relative importance of individual elements ranged from 82.14% to 96.43%

Conclusion 1

Elements in the cognitive domain that practitioners could adapt to or change ranked more important than cognitive elements over which practitioners had little control. For example, inference modalities ranked first and physical elements ranked last. The top ranked item in the technical category was inventory administration procedures which directly involved the practitioner, whereas, near the bottom of the ranking was the cost of the inventory which most directly involved the administrator rather than the practitioner. Reliability, validity, norms and development of the inventory which are of great concern to the developers of the instrument and researchers, ranked last in importance on the list of the elements.

Research Recommendation 1

The research sample needs to be broadened to include administrators and practitioners. If practitioners were included in the sample, it could be investigated if they would rank the 83 elements in the same ways as did the experts. Research needs to be conducted to explore why the experts consider items such as validity, reliability, norms, and test development least important in a list of 83 important elements of cognitive/learning style.

Result 2

Experts were able to reach a fairly high consensus about which elements were the most important to differentiate effectively and efficiently among widely used inventories.

Conclusion 2

The Delphi method is an appropriate method to bring consensus among experts on this topic.

Research Recommendation

The Delphi method could be used effectively as a research tool when this research is replicated with a broader and larger sample.

Result 3

The experts' opinions were that definition and categorization of terms were problematic with inventories of cognitive/learning style. This was especially true of the cognitive elements in the inventories.

Conclusion 3

If terms are not well defined, it is difficult to conduct valid research on cognitive/learning style.

Research Recommendation 3

Research is needed to continue to define what is cognitive/learning style, what inventories of cognitive/learning should measure, and what the terms that describe the elements of cognitive/learning style mean. Any research on style done at this time needs to have definition of terms as part of the research instrument. Some research needs to be done to group the elements of style into logical categories and merge similar elements together in order to simplify the list of elements.

Question 4

Statement of Question 4

What is the perceived range of elements of cognitive/learning style inventories in terms of their respective importance?

Results, Conclusions, and Recommendations for Question 4

Result 1

In Round 1, 42 elements or characteristics of cognitive/learning style inventories were developed by the experts. In Round 2, the experts ranked the 42 characteristics. During Round 3, the experts were asked to comment on the rankings, and in this round agreement or disagreement (convergence to consensus) was obtained. There was a 96.42% agreement reached with the rankings and a 3.58% disagreement reached with the rankings by the experts. The 5 most important characteristics or elements of cognitive/learning style inventories selected by the experts were:

1. Instruments which diagnose learning styles,
2. A series of questions designed to assess preferences of learners,
3. Assessment tool for preferences,
4. A series of processing tasks to assess learners' strengths and weaknesses, and
5. Survey of preferences.

Conclusion 1

Terminology for cognitive/learning style and the inventories that measure style needs to be clarified and standardized. Although the reason to use cognitive/learning style inventories that was ranked as the number 1 characteristic of cognitive/learning style inventories was to diagnose learning style, it is clear from the rest of this research that the experts have varying opinions about what constitutes learning style. The purposes of using a cognitive/learning style inventory need to be made clear to the practitioner. Of the top 10 answers, 3 refer to characteristics of cognitive/learning style as dealing in some way with preferences. However, one of the major disappointments with cognitive/learning style inventories is that they are self reports, and preferences are usually measured by self reports.

Research Recommendation 1

Further research needs to be done to determine what are the characteristics of cognitive/learning style and the inventories that measure style. Research needs to be done to establish the purpose or purposes of cognitive/learning style inventories, and the appropriate ways to measure style.

Question 5

Statement of Question 5

What elements are perceived as important for a model that assists practitioners in selecting an appropriate cognitive/learning style inventory?

Results, Conclusions, and Recommendations for Question 5

Result 1

The experts were able to identify and rank reasons to use and disappointments with inventories of cognitive/learning style. In Round 1, the experts were asked to generate 2 lists that defined the elements that they perceived as important for a model that would assist practitioners in selecting an appropriate cognitive/learning style inventory. The first list that the experts generated was the reasons to use cognitive/learning style inventories. The second list they generated was the disappointments with cognitive/learning style inventories.

In Round 2, the experts assigned points from which rankings were built for each of the lists. There were 39 reasons to use cognitive/learning style inventories. The 5 highest ranked reasons to use the inventories were:

1. To help individuals in the learning process,
2. To do research,
3. To provide a framework for designing new teaching methods,
4. To find out if students' learning styles respond to teachers' teaching styles, and
5. To determine how to diversify learning materials.

There were 48 disappointments with cognitive/learning style inventories ranked. The 5 highest ranked disappointments with the inventories were:

1. Variations in different inventories of definitions of learning style,
2. Lack of validity,
3. Poor direction on how to apply results to classroom,
4. Lack of reliability, and
5. Too simplistic.

In Round 3, the experts were asked to comment on the rankings and from those comments agreement or disagreement (convergence to consensus) was ascertained. For both reasons to use cognitive/learning style inventories and disappointments with cognitive/learning style inventories, there was 89.29% agreement with the rankings and 10.71% disagreement with the rankings.

Conclusion 1

The reasons to use and disappointments with inventories of style provided a framework that practitioners could use to make decisions about using inventories of cognitive/learning style. This is an exploratory study, and some of the reasons to use and the disappointments with inventories of cognitive/learning style may reflect the bias of the sample. For example, the number 2 reason to use inventories of style was "to do research."

Research Recommendation 1

This research needs to be replicated with a broader and larger sample to determine if the same reasons to use and disappointments with inventories of cognitive/learning style exist when practitioners and administrators are added to the sample.

Result 2

There were 39 reasons to use and 48 disappointments with inventories of cognitive/learning style identified and ranked by the experts.

Conclusion 2

The lists reacted to by the respondents of reasons for using and the list of disappointments with inventories of style were too long. These lists were near the end of the inventory and may or may not have received the careful scrutiny of all the experts.

Research Recommendation 2

Some research needs to be done to group the lists of reason to use and disappointments with cognitive/learning style inventories into logical categories and merge similar elements together in order to simplify and shorten the lists. Using further research methods, including the Delphi, this could be accomplished.

Result 3

There seems to be confusion among the experts about the definition of cognitive/learning style, and what should be included in cognitive/learning style inventories.

Conclusion 3

In order for experts, practitioners, and administrators to believe in the reliability, validity, and usefulness of the inventories, there needs to be clarification of what is cognitive/learning style and what should be included in cognitive/learning style inventories. What should be included in the inventories should flow from the definition of cognitive/learning style. Already, some experts have stopped using style inventories because of this confusion. The trend will continue and an important educational tool will be lost if the clarifications are not accomplished.

Research Recommendation 3

Research needs to be done to clarify and standardize the term cognitive/learning style, and then to determine what should be included in cognitive/learning style inventories.

Result 4

Experts could identify a sufficient number of elements and characteristics of cognitive/learning style inventories to build a model for practitioners to use to choose among widely used inventories of style.

Conclusion 4

A model can be constructed, using elements proposed by the respondents, to assist practitioners in choosing among widely used inventories of cognitive/learning style, to find inventories that best suits their instructional needs.

Research Recommendation 4

The model developed by this researcher needs to be tested for validity and for "user friendliness."

A MODEL FOR EVALUATING AND CHOOSING AMONG WIDELY USED ASSESSMENT INVENTORIES OF COGNITIVE/LEARNING STYLE

The data from this research were used to construct a model that practitioners could use to determine the appropriateness of using a cognitive/learning style inventory as well as determining which one to use. The model has three major parts. The first part, which is the directional tool of the model, is the flow chart (see Figure 3). Practitioners will use the flow chart to organize their use of the model. Matrices constitute the second major part of the model. At each decision point in the flow chart, practitioners are directed to a matrix which consists of checklists to help them determine whether they should use a cognitive/learning style inventory and, if they should use one, which one to use. The third major part of the model consists of information sheets (see Table 20). The first information sheet consists of a short description of selected inventories. For example, information that might be included about the inventory would be publisher, content, time to administer, etc. The second information sheet is a definition of terms found in Matrix C. Although this research indicates that there is some confusion of the definitions of some of these terms, this researcher has reviewed several books on cognitive/learning style and has selected definitions that are most commonly reported. They should assist the practitioner to evaluate the inventories.

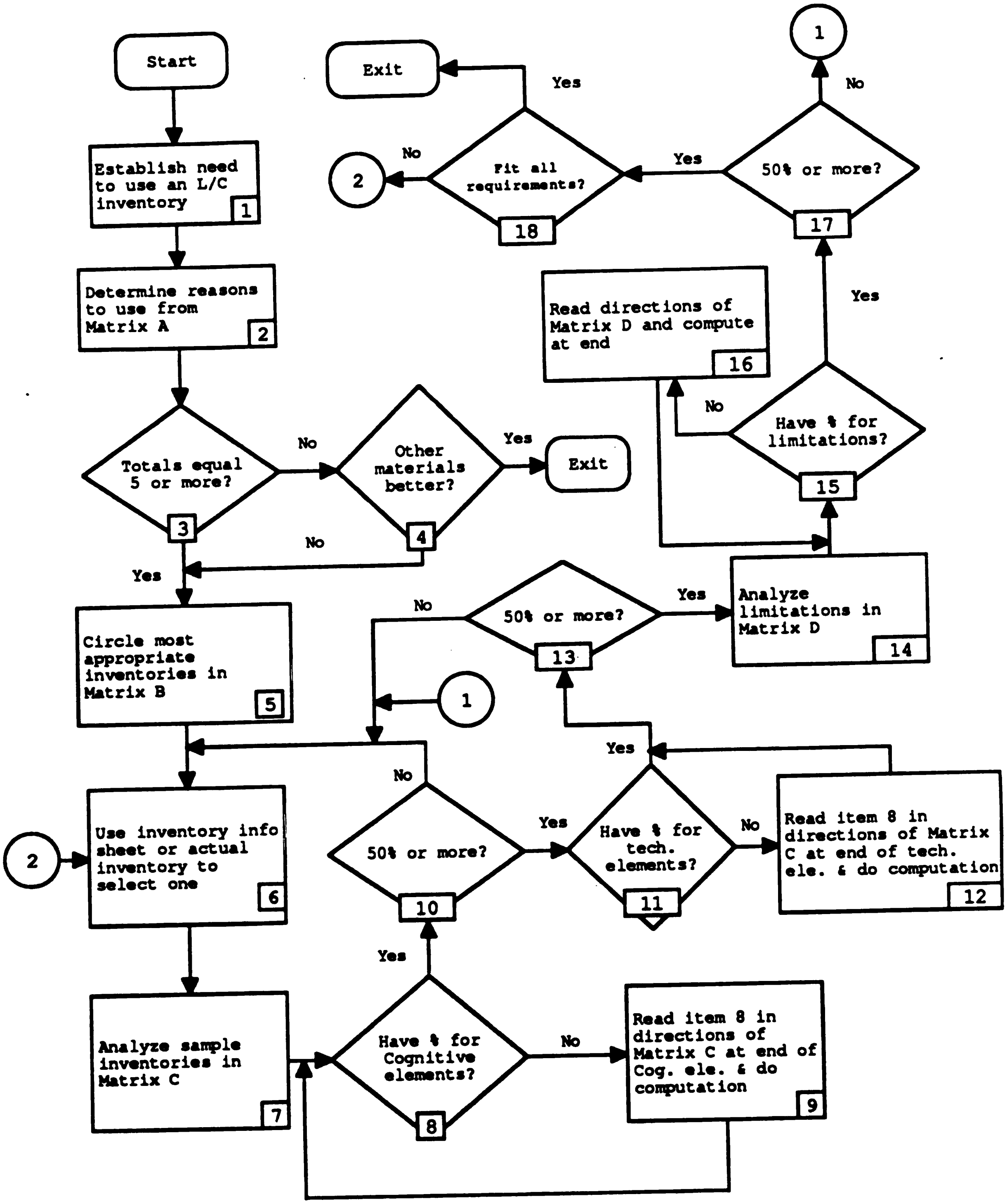

Figure 3: Flow Chart for Choosing an Inventory.

Table 20

A Model For Evaluating and Choosing Among Inventories of Cognitive/Learning Style

MATRIX A INSTRUCTIONAL GOALS
Ranked and Weighted List
of Reasons to Use
Cognitive/Learning Style Assessment Inventories

DIRECTIONS:

1. **Read each statement.**
2. **Circle the number to the right of the statement if it applies to your instructional goal or goals.**
3. **Total circled numbers**
4. **Go back to flow chart Step 3**

REASON	**CIRCLE IF APPLIES**
to help individuals in the learning process	7
to do research	5
to provide a framework for designing new teaching methods	5
to find out if students' learning styles respond to teachers' teaching styles	5
to determine how to diversify learning materials	3
to determine cognitive style	3
to determine learners' strengths	3
to pinpoint individual differences that correlate with student behaviors	3
to teach teachers how to maximize their teaching	3
to address learning problems	3
to predict learning	3
to pinpoint individual differences that correlate with teacher behaviors	3
to personalize education	3

SUB TOTAL OF CIRCLED NUMBERS ON THIS PAGE ____

CONTINUE TO NEXT PAGE

(Table 20 continued)

REASONS TO USE	CIRCLE IF APPLIES
to determine learners' weaknesses	3
to find ways to help students	3
to help make diagnosis	3
to help college students learn how they learn	3
to determine a general picture of the learner	3
to remind teachers of the diversity of any group of learners	3
to aid in structuring educational augmentation programs	3
to help in the self actualization process	3
to assess how learners perceive their own behavior	1
to provide a framework to critique traditional teaching methods	1
to help advisors work with individual students	1
to determine the psychometric properties of inventories	1
to satisfy intellectual curiosity	1
to find the strengths of a majority of learners in a given situation	1
to investigate if developmental conditions affect learning preferences	1
to supplement IQ tests	1
to discriminate performance differences	1
to assess how teachers perceive their own behavior	1
to predict the success of independent study students	1
to assess children's skills	1
to help ensure that learning occurs without gaps	1

Sub Total ON THIS PAGE ______

CONTINUE TO NEXT PAGE

(Table 20 continued)

REASONS TO USE	CIRCLE IF APPLIES
in order to investigate if different brain treatments enhance learning	1
to help college students learn about themselves	1
because they are valid	1
to help make student placements	1
to check on the consistency of patterns among various learning theories	1

Sub TOTAL OF CIRCLED NUMBERS ON THIS PAGE ________

ADD all sub totals ________

RETURN TO FLOW CHART STEP 3

(Table 20 continued)

MATRIX B INVENTORY MATRIX

Ranked List
DIRECTIONS:
1. Circle any inventories that are age appropriate.
2. Using the inventory information sheet (included in this packet-not developed yet) select an inventory that seems to fit your instructional need.
3. After you have finished, go to flow chart Step 6.

INVENTORY	AUTHOR(S)	AGE RANGES*
Group Embedded Figures (GIFT)	Witkin	E,M,H,A
Learning Style Inventory (LSI)	Kolb	M,H,A
Learning Style Inventory (LSI)	Dunn, Dunn, & Price	E,M,H,A
Myer-Briggs Type Indicator	Myer & Briggs	M,H,A
Embedded Figures Test (EFT)	Witkin	E,M,H,A
Learning Style Inventory (LSI)	Canfield	M,H,A
Matching Familiar Figures Test (MFFT)	Kagan	P,E,M,H, A
NASSP Learning Style Inventory	Keefe	M,H,A

* Age Ranges with which experts used these inventories:
P= Preschool H= Grades 9-12
E= Grades K-5 A= Adult
M= Grades 6-8

CONTINUE TO NEXT PAGE

(Table 20 continued)

INVENTORY	AUTHOR(S)	AGE RANGES*
Your Style of Learning & thinking	Torrance	A
Hidden Figures Test (HFT)	French, Ekstrom & Price	H,A
Transaction Ability Inventory	Gregorc	M,A
Cognitive Style Interest Inventory (CSI)	Hill	E,M,H,A
Cognitive Profiles	Letteri	E,M,H,A
Edmonds Learning Style Identification Exercise (ELSIE)	Reinert & Edmonds	H,A
Learning Style Inventory (LSI)	Renzulli & Smith	M,H,A
Test of Conceptual Style	Sigel	E,M,H
Barbe/Swassing Modality Kit	Barbe & Swassing	E
Childrens Embedded Figures Test (CEFT)	Witkin	E,M
Brown & Cooper	Brown & Cooper	A

* Age Ranges with which experts used these inventories:
P= Preschool H= Grades 9-12
E= Grades K-5 A= Adult
M= Grades 6-8

CONTINUE TO NEXT PAGE

(Table 20 continued)

INVENTORY	AUTHOR(S)	AGE RANGES*
Hunt Conceptual Level	Hunt	A
Teaching Center Learning Style Inventory	Murdock	E

RETURN TO FLOW CHART STEP 6

*** Age Ranges with which experts used these inventories:**
P= Preschool H= Grades 9-12
E= Grades K-5 A= Adult
M= Grades 6-8

(Table 20 continued)

MATRIX C SELECTION WORKSHEET

INVENTORY____

AUTHOR ____

PUBLISHER____

ADDRESS ____

All lists of cognitive and technical elements and subelements have been ranked by experts in the field. The cognitive element that appears first on this worksheet is considered the most important cognitive element with each following element of lesser importance. Subelements are ranked in the same way. The list of technical elements and subelements begins a new ranking and it is ranked the same way the cognitive elements and subelements are ranked.

DIRECTIONS FOR COGNITIVE AND TECHNICAL ELEMENTS
After collecting a sample inventory and manual or the inventory information sheet in this packet is located after Matrix D, complete the following steps:

1. Read the first major element, (right below line of asterisks in bold print) and determine if the element is important to your instructional goals. If it is important, check Col.1 IMPORTANT.

2. Then go to any subelements under the major element, and use the same procedure. Note, some major elements do not have subelements. A ranked list of possible subelements that might be tested by the inventory may be included for your information.

3. Add any comments in the comment section that you believe important to your decision making process.

4. If a major element is not important to your instructional goals, go directly to the next line of asterisks which will be the next major element.

5. Repeat procedures 1-4 until the entire list is done.

6. Repeat for technical elements

7. On the next page, using the test materials and manuals or the information inventory sheet, determine if checked IMPORTANT in Col.1. is tested or applicable. If it is, check Col.2 YES.

(Table 20 continued)

8. To see how well an inventory will meet your needs, total Col.1 and then total Col.2. Then divide Col.2 by Col.1. The percentage you will derive will tell you what percentage of the cognitive or technical areas you want to find out about will be measured by this inventory.

COGNITIVE ELEMENTS

ELEMENT	COL.1 IMPORTANT	COL.2 YES
**		
Inference Modalities (How a learner perceives, thinks, problem solves, and remembers		
Field dependence/independence *		
Abstract/concrete *		
Self direction/need for structure *		
Analytical/global *		
Reflective/impulsive *		
Analytical/categorical/inferential *		
Verbal/spatial preference *		
Serial/simplicity *		
Focusing/scanning *		
Complexity/simplicity *		
Leveling/sharpening *		
Random/sequential *		
Structure/looseness *		
COMMENTS:		
Sub TOTALS FOR COL.1 AND COL. 2	_____	_____

*Defined in Definition Information Sheet (located after Matrix D)

CONTINUE TO NEXT PAGE

(Table 19 continued)

ELEMENT	COL.1 IMPORTANT	COL.2 YES
**		
Sensory Orientations (How a learner uses the five senses)		
Ranked information list		
in a varied mode		
auditory		
visual		
tactile		
kinesthetic		
COMMENTS:		
**		
* **Affective Elements** (How the learner uses attention, emotion. valuing)		
Motivation *		
Locus of control *		
Persistence *		
Sensing/intuition *		
Thinking/feeling *		
Tolerance of ambiguity *		
Anxiety levels		
Responsibility		
Judgement/perception *		
Extroversion/introversion *		
Leader/follower *		
Proxemics *		
Empathy *		
Histrionics *		
SUB TOTALS COL.1 AND COL.2	______	______

*Defined on Definition Information Sheet (located after Matrix D)

CONTINUE TO NEXT PAGE

(Table 20 continued)

ELEMENT	COL.1 IMPORTANT	COL.2 YES
Past/present/ future orientation *		
COMMENTS:		
**		
Sociological Elements (with whom the student learns best) Ranked Information List in a varied mode with peers alone with authority figure in mixed teams		
COMMENTS:		
**		
Physical Elements (Environmental conditions where student learns)		
Design of learning environment		
Time preference		
Sound		
Mobility		
Light		
Warmth		
COMMENTS:		

__TOTAL ALL COLS. 1_____ TOTAL ALL COLS. 2_____
DIVIDE TOTAL COL.2 BY TOTAL COL.1=_____% of goals met

*Defined on Definition Information Sheet (located after Matrix D)

END OF COGNITIVE ELEMENTS

CONTINUE ON TO TECHNICAL ELEMENTS NEXT PAGE

(Table 20 continued)

TECHNICAL ELEMENTS

ELEMENT	COL.1 IMPORTANT	COL.2 YES
** Inventory Administration Procedures (Ways the inventory can be given)		
mixed mode		
written		
oral		
visual (ex. pictures, charts, models, & graphs)		
COMMENTS:		
** Manuals (what should be included)		
should include an examiner's manual		
should have a scoring key		
examiner's manual should have bibliography		
should have follow up on how to get specific information on variables		
examiner's manual should have graphs & charts		
COMMENTS:		
** Time Needed to Test		
30 min. or less		
15 min. or less		
45 min. or less		
60 min. or less		
time is unimportant		

CONTINUE TO NEXT PAGE

(Table 20 continued)

ELEMENT	COL.1 IMPORTANT	COL.2 YES
2 hrs. or less		
COMMENTS:		
** Test Booklet		
should be reuseable		
students should be able to write in it		
younger students-should be able to write in it		
older students-should be reuseable		
COMMENTS:		
** Student Response to Inventory		
mixed mode		
written		
visual		
oral		
movement (kinesthetic)		
COMMENTS:		
** Scoring		
hand & machine scoring should be possible		
machine scored		
hand scored		
COMMENTS:		

CONTINUE TO NEXT PAGE

(Table 20 continued)

ELEMENT	COL.1 IMPORTANT	COL.2 YES
**		
Total Cost (Scoring, Booklet, & Score Sheets)		
.25 or less per pupil		
cost is unimportant		
.26-.50 per pupil		
.51-.75 per pupil		
.76-1.00 per pupil		
COMMENTS:		
**		
Manuals Should Report		
interpretation of scoring		
inventory reliability		
inventory validity		
norms		
development of inventory		
types of validity		
how, why, & which items are weighted		
how the inventory meets <u>all</u> APA standards		
COMMENTS:		

TOTAL <u>ALL</u> COLS. 1_____ TOTAL <u>ALL</u> COLS. 2_____

DIVIDE TOTAL COL.2 BY TOTAL COL.1=_____% of goals met

END OF TECHNICAL ELEMENTS

RETURN TO FLOW CHART STEP 8

(Table 20 continued)

Matrix D Limitations

Directions:

1. Read Limitation
2. If it is important to your instructional situation, check Col. 1 IMPORTANT LIMITATION. Do this with the entire list of limitations.
3. Look at the inventory and its manual(s) that you are going to use. Read each checked limitation or acknowledge the limitation and describe how to compensate for it, check Col. 2 located next to Col. 1.
4. Total Col. 1, and then total Col. 2. Obtain a percentage of how many of your important limitations have been resolved by dividing Col. 2. by Col. 1.

5. Return to Flow Chart Step 15

LIMITATION	COL. 1 IMPORTANT LIMITATION	COL. 1 LIMITATION RESOLVED
Variation in different inventories of learning style		
Poor direction on how to apply results to classroom		
Lack of validity		
Lack of reliability		
Too simplistic		
No classroom application in manuals		
Measures elements which teachers have little or no control		
Lack of cognitive measures for elementary students		
Leads to unwarranted conclusions because of lack of validity		

CONTINUE TO NEXT PAGE

(Table 20 continued)

LIMITATION	COL.1 IMPORTANT LIMITATION	COL.2 LIMITATION RESOLVED
Lack of empirical evidence		
Preference focus is superficial		
No information on how area being tested relates to other aspects of learning		
Not well researched		
Lack of documentation of effectiveness of inventory		
Lacks a through grounding in experimental psychology		
Poor norming		
Lack of norms for the handicapped		
No theoretical base		
Lack of information on development of inventory		
Lack of interpretation		
Not consistent		
Skimpy manuals		
Measures for primary children ineffective		
No manuals on some		
Too much self reporting		

CONTINUE TO NEXT PAGE

(Table 20 continued)

LIMITATION	COL.1 IMPORTANT LIMITATION	COL.2 LIMITATION RESOLVED
Honesty of self reporting		
Self reporting among children is unreliable		
Scoring is difficult		
Lack of direction for teachers on how to make choices about which instrument to use		
Too few items in each category		
Need to be sent out to be scored		
Prescriptive nature of manuals		
Poor development		
Too expensive		
Too high of a correlation with measures of IQ		
Reassessment too time consuming		
Measures too few variables		
Too general		
Ignores findings of experimental psychology		
Not enough consistency across dimensions		
The list mainly of a checklist		

CONTINUE TO THE NEXT PAGE

(Table 20 continued)

LIMITATIONS	COL. 1 IMPORTANT LIMITATIONS	COL. 2 LIMITATION RESOLVED
Not comprehensive		
Misnomer-designed to measure ability not style		
Ipsative scoring scales		
Too cumbersome		
Difficulty of overlap in different instruments		
Amount of overlap in different instruments		
Lack of variability in administration		

TOTAL ALL COLS. 1_____ TOTAL ALL COLS. 2_____

DIVIDE TOTAL COL. 2 BY TOTAL COL.1=_____% of important limitations resolved

RETURN TO FLOW CHART STEP 15

(Table 20 continued)

INVENTORY INFORMATION SHEET

Below are summaries and statements of selected inventories made by people in the field of cognitive/learning style inventories. This is to be used in conjunction with Matrix A, B, C, and D to aid you in making selections of appropriate inventories for your instructional needs. However, it is always better to use the actual inventories when trying to evaluate which inventories to use.

Another source you can use for further information is Tests In Print An Index To Tests, Test Reviews, And The Literature On Specific Tests: Ed. James V. Mitchell Jr.: Publisher Burows Institute of Mental Measures, University of Nebraska at Lincoln, 1983.

Canfield-Learning Style Inventory
By Albert A. Canfield and Judith S. Canfield. Humanics Media, P.O. Box 188, Rochester, MI 48063.

Self-report instrument based on rank ordering of choices for each of 30 questions. For use with junior high and up. Takes about 15 minutes (Cornett, 1983, p. 33).

The purpose of the inventory is to make instruction more effective by matching teaching and learning styles. There are 2 forms. These are categories and sub-areas included in the test.
Conditions
peer, organization, goal setting, independent, competition, authority, instructor, detail
Content
numeric, qualitative, inanimate, people
Mode
listening, reading, iconic, direct experience
Expectation
A-expects to achieve at an outstanding level of performance, B-Expects to achieve at a good level of performance, C-expects to perform at an average level, D-expects to perform below average
Reliabilites for this inventory range from .59 to .92 with split -half reliabilities above .95. No test-retest reliablilities. Separate norms for males and females and different age groups. Several studies reported to support validity, and 1 study that does not support validity of the inventory. (Blakemore, McCray & Coker, 1984).

(Table 20 continued)

This instrument is involved with instructional preference or the individual's choice of the environment in which they learn best and according to Curry (1987) will be the least stable across time and most easily influenced by instruction.

According to Curry (1987), poor reliability evidence and poor validity evidence (p. 22).

Dunn-Learning Style Inventory
By Rita Dunn, Kenneth Dunn, and Gary E. Price. Price Systems, Box 367, Lawrence, KS 66046-0067.

> Self-report questionnaires yielding information about how a given student learns. There are 36 subscales covering 18 elements in four areas: Environmental, Emotional, Sociological, and Physical. It is computer scored. (Cornett, 1983, p. 33)

Used with grades 3-12. The inventory has 104 items is self reported and can be administered in a written format, on tape, or orally. It has a true/false format and takes approximately 25-30 minutes to finish. The instrument is computer scored by the publishers. It can be used with individuals or groups. There is information in the manual on how to adapt testing results to teaching situations. This inventory has been widely researched. It has a 56% test-retest reliability. However, reliabilities of the separate factors are low. The authors also report discriminant validity studies which discriminated between high and low math achievers, gifted and nongifted students, learning disabled and nonlearning disabled students, and male and female students (Blakemore, McCray, & Coker, 1984).

This instrument is involved with instructional preference or the individual's choice of the environment in which they learn best and according to Curry (1987) will be the least stable across time and most easily influenced by instruction.

According to Curry (1987), good reliability evidence and good validity evidence (p.24).

French, Eckstrom and Price-Hidden Figures Test 1963

> Subjects are required to determine which of five simple figures is embedded in a more complex pattern. The

(Table 20 continued)

> factor identified is flexibility of closure,. ... The number of correctly identified figures is the total score on this test. The HFT differs from the GEFT in that there is uncertainty as to whether the norm figure is hidden in the search figure because more norm figures are presented. In the GEFT only one norm figure must be located in the search figure (Swinnen, Vandenberghe, & Belgium, 1986, p. 56).

Grasha and Reichman Student Learning Style
By Anthony F. Grasha and Sheryl W. Riechmann. Institute for Research and Training in Higher Education, University of Cincinnati, Cincinnati, OH 45221, 1974.

> A hand-scored, self-report inventory of 90 items designed to elicit student attitudes toward the courses taken in college or high school and to identify related learning style. Six styles are described: Independent, Avoidant, Collaborative, Dependent, Competitive, and Participant (Cornett, 1983, p. 34).

This inventory was designed as a research tool to study matching teaching and learning styles. It takes about 45 minutes to complete. It has 6 scales. They are: independent, dependent (measures intellectual curiosity and initiative); participant, avoidant (measures the degree the students like the traditional classroom format); competitive, collaborative (measures the degree that students like to share ideas and talents when learning.

Authors report test-retest coefficients ranging from .76 to .83. Very few reported tests of validity (Blakemore, McCray & Coker, 1984).

This instrument is involved with instructional preference or the individual's choice of the environment in which they learn best and according to Curry (1987) will be the least stable across time and most easily influenced by instruction.

According to Curry (1987), fair reliability evidence and fair validity evidence (p. 27).

(Table 20 continued)

Gregorc-Transaction Ability Inventory
By Anthony F. Gregorc Department of Secondary Education, University of Connecticut, Box U-33, Stors, CT 06268.

A self-report instrument based on a rank ordering of four words in each of 10 sets revealing four combinations of learning preference dualities: 1)Abstract Sequential, 2)Abstract Random, 3)Concrete Sequential, and 4)Concrete Random. Observation and interviews are suggested as adjuncts to the instrument. Administration time is approximately five minutes. Can be used with junior high students and up (Cornett, 1983, p. 35).

Gregorc believes that inborn predispositions are the reason styles emerge. Styles can be encouraged and disciplined, and students can be encouraged to use other styles at times by style flexing (De Bello, 1988).

Hill-Cognitive Style Interest Inventory
By Joseph Hill: Hill Educational Sciences, Research Foundation, P.B. Box 5053 West Bloomfield, MI 48033, 1971.

This is one of the first learning instruments developed. It was used at Oakland Community College in Bloomfield, Michigan. It tests the learner on 27 variables relating to 3 main factors: (1) how the student processes information, (2) how the student receives information, and (3) how the student is influenced by others. The instrument is targeted for high school students and above, and takes about 3 hours to finish the 200 self-report item test.
Reliability and validity have not been established for this test. It is a computer scored test, but Oakland Community College which used to score it, no longer scores it (Blakemore, McCray, & Coker, 1984).

This instrument is involved with instructional preference or the individual's choice of the environment in which they learn best and according to Curry (1987) will be the least stable across time and most easily influenced by instruction.

According to Curry (1987), no reliability evidence and no validity evidence.

(Table 20 continued)

Hunt-Conceptual Level(Paragraph Completion Method)
By David E. Hunt et al. Assessing Conceptual Level by the Paragraph Completion Method. Ontario Institute for Studies in Education, 252 Bloor Street, West, Toronto, ON. M5S IV6, 1978.

> A semi-projective method to assess the degree of classroom structure needed by students. Conceptual level shown by completing six incomplete statements involving conflict or uncertainty. (1. What I think about rules..., 2.When I am criticized..., 3. What I think about parents..., 4. When someone does not agree with me..., 5. When I am not sure..., 6. When I am told what to do...). Special training required to administer (Cornett, 1983, p. 36).

Hunt describes this instrument as testing how the student learns, not what he or she learns. He also thinks it measures the student's thought process. In completion of the 6 paragraphs younger students (grades 6-13 are allowed 3 minutes per paragraph, older adults are allowed 2 minutes per paragraph. The tests measures the amount of structure a student needs to learn.
Test-retest reliabilities over 3 months .67: over 1 year range from .45 to .56. Conceptual level has been found to have a low correlation with I.Q. which Hunt feels proves that conceptual level is distinct from I.Q. Validity is not addressed (Blakemore, McCray, & Coker, 1984).

This inventory, according to Curry (1987), measures Information Processing Style. He describes it in these ways:

> Concepts at this level describe the individual's intellectual approach to assimilating information and in that respect these concepts can be related to the classic cognitive information processing model. Information processing is a set of processes that function at the intersection between fundamental personality levels, individual differences and environmentally offered learning format choices (p. 10-11).

According to Curry (1987), fair reliability evidence and fair validity evidence (p. 36).

(Table 20 continued)

Kagan-Matching Familiar Figures Test
By Jerome Kagan William James Hall, Harvard University 33 Kirkland St., Cambridge, MA 02138.

> MFFT assesses individual differences in the speed and adequacy of information processing and concept formation on a continuum of reflective to impulsive. The teste is shown 12 pictures and, in each case, six similar alternatives, only one of which is correct. Reflectives tend to take longer and to produce more correct solutions than impulsives (Cornett, 1983, p. 35).

This inventory, according to Curry (1987) measures Cognitive Personality Style.

> This is defined as the individual's approach to adapting and assimilating information. This is an adaptation that does not interact directly with the environment, rather these are underlying and relatively permanent personality dimensions. These constructs form part of the construct description of personality (p.14-5).

According to Curry (1987), fair reliability evidence and fair validity evidence (p. 44).

Keefe-NASSP Learning Style Profile
A 42 page, 126 item assessment test for secondary students. Results are computer scored and respondents receive a computer print out of their results. This is a amalgamated approach. Study skills, environmental factors, affective factors, and physiological factors are tested using the Dunn approach, cognitive skills are addressed using the GEFT approach, Perceptual responses are tested using the ELSIE approach. This is the first inventory that has been developed that is a composite (De Bello, 1988).

Kolb-Learning Style Inventory
By David Kolb McBer and Company, 137 Newbury Street, Boston, MA 12116, 1981.

> A 5-to 10-minute self-report based on a rank ordering of four words in each of nine different sets. Each word represents one of four learning modes: feeling (Concrete

(Table 20 continued)

Experience), watching (Reflective Observation), thinking (Abstract Conceptualization) and doing (Active Experimentation). For use with upper-grade students. Administration time is approximately 10 minutes (Cornett, 1983, p. 35).

This instrument has been heavily researched. Split-half reliabilities ranges from .55 to .82 for each of the factors. Test-retest reliabilities ranged from .49 to .60. Several correlational studies have been done with other inventories. A large bibliography with articles relating to the reliability and validity of this instrument is included in the manual (Blakemore, McCray and Coker, 1984).

This inventory, according to Curry (1987), measures Information Processing Style. He describes it in these ways:

> Concepts at this level describe the individual's intellectual approach to assimilating information and in that respect these concepts can be related to the classic cognitive information processing model. Information processing is a set of processes that function at the intersection between fundamental personality levels, individual differences and environmentally offered learning format choices (p. 10-11).

According to Curry (1987), strong reliability evidence and fair validity evidence (p. 39).

Letteri-Cognitive Profiles
By Charles Letteri. Cognitive Profile: Basic Determinate of Academic Achievement. Burlington, VT: Center for Cognitive Studies, 1980.

> Seven tests of cognitive style that, in combination, predict student achievement level as measured by standardized achievement test scores. The seven dimensions are: 1)Field Independence/Dependence, 2)Scanning/Focusing, 3)Breadth of Categorization, 4)Cognitive Complexity/Simplicity, 5)Reflectiveness/Impulsiveness, 6)Leveling/Sharpening, and 7)Tolerant/Intolerant (Cornett, 1983, p. 34).

This original instrument was rewritten into an all-inclusive combined assessment inventory which represent skills on a bipolar continuum with one extreme being highly analytic and

(Table 20 continued)

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the other extreme highly global. Letteri's approach is mainly a clinical approach but, he does have some recommendations for schools (De Bello, 1988)

Malcolm et.al.-Learning Style Identification Scale
By Paul Malcolm, William Lutz, Mary Gerken, and Gary Hoeltke. Publishers Test Service (McGraw-Hill), 2500 Garden Road, Montery , CA 93940, 1981.

A short, (24-item) self-scored rating scale based on the concept of learning style as the method students use to solve any problem that they encounter in their educational experiences. Five styles are identified based on classification of information reception and use, cognitive development, and self-concept (Cornett, 1983, p. 32).

McCarthy-4MAT Inventory
By Bernice McCarthy

A combination of the instruments developed by Torrance and Kolb.

In this model learners are grouped into 4 style clusters. The clusters are: Innovatives (curious, aware, and perceptive); Analytics (critical, fact seeking, and philosophizing); Common-sense (hands on, practical, and now oriented); Dynamics (risk taking, adaptive, inventive, and enthusiastic). It also assesses left-brain functions (verbal and field independent) and right-brain functions (visual/spatial and field dependent). The purpose of the test is to identify the style of the learner so that for 25% of the time the learner can be taught in his or her style and 75% of the time the learner can be challenged in other styles (De Bello, 1988).

Myer and Briggs-Myer-Briggs Type Indicator
By Isabel Briggs Myers and Katherine C. Briggs. Consulting Psychologist Press, Inc., 577 College Avenue, Palo Alto, CA 94306, 1976.

(Table 20 continued)

> A measure of personality dispositions and interests based on Jung's theory of types. Suitable for early adolescents through adults. Provides four bipolar scales that can be reported as continuous scores or reduced to types. Requires special training to administer (Cornett, 1983, p. 33).

This inventory, according to Curry (1987), measures Information Processing Style. He describes it in these ways:

> This is defined as the individual's approach to adapting and assimilating information. This is an adaptation that does not interact directly with the environment, rather these are underlying and relatively permanent personality dimensions. These constructs form part of the construct description of personality (p.14-5).

According to Curry (1987), good reliability evidence and strong validity evidence (p. 45).

<u>Papalia-Learning Style Modalities</u>
By A. Papalia "Assessing Students' Learning Styles and Teaching for Individual Differences." <u>Hispania</u>. 61(May): 318-22 1978.

This instrument is involved with instructional preference or the individual's choice of the environment in which they learn best and according to Curry (1987) will be the least stable across time and most easily influenced by instruction. This is a 28 item test consisting of 5 point Likert type scales.

According to Curry (1987) no reliability evidence and no validity evidence (p. 30).

<u>Reinert and Edmonds-Edmonds Learning Style Identification Exercise</u>
By Harry Reinert "One Picture Is Worth A Thousand Words? Not Necessarily!" <u>The Modern Language Journal</u> 60(1976): 160-168.

> ELSIE provides a profile of students' preferred perceptual styles based on patterns of responses to 50 common English words. Four general categories are defined: Visualization, Written Word (reading),

(Table 19 continued)

Listening, and Activity (kinesthetic) (Cornett, 1983, p. 37).

This inventory, according to Curry (1987), measures Information Processing Style. He describes it in these ways:

> Concepts at this level describe the individual's intellectual approach to assimilating information and in that respect these concepts can be related to the classic cognitive information processing model. Information processing is a set of processes that function at the intersection between fundamental personality levels, individual differences and environmentally offered learning format choices (p. 10-11).

According to Curry (1987), poor reliability evidence and no validity evidence (p. 38).

This instrument does not have a strong research base (De Bello, 1988).

Renzulli and Smith-Learning Style Inventory
By Joseph Renzulli and Linda Smith, Creative Learning Press, P.O. Box 320, Mansfield Center, CT 06250, 1978.

> Both teacher and student forms are available for this 65-item instrument designed to measure attitude toward nine modes of instruction. Students and teachers indicate their reactions using a Likert scale ranging from very unpleasant to very pleasant. Forms are on optical scanning sheets and are scored by computer. Requires 30 minutes to administer and can be used in grades 4 through 12 (Cornett, 1983, p.33).

The stated major purpose of this instrument is to help the teacher to individualized instruction. The nine modes of instructional practices that are measured are: (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. The computer prints out lists of students scores' on each factor as well as student preferences for specific teaching methods. Test items contain content and factor analysis, and reliability ranges from .66 to .77. Reliability studies were done using 700 seventh and eighth grade students (Blakemore, McCray, & Coker, 1984).

(Table 20 continued)

This instrument is involved with instructional preference or the individual's choice of the environment in which they learn best and according to Curry (1987) will be the least stable across time and most easily influenced by instruction.

According to Curry (1987), poor reliability evidence and fair validity evidence (p. 31).

Schmeck-Inventory of Learning Processes
By Ronald R. Schmeck, Fred Ribic, and Nerella Ramanaiah. "Development of a Self-Report Inventory for Assessing Individual Differences in Learning Processes," Applied Psychological Measurement 1 (1977): 413-31.

> A 62-item true-false self-report inventory grouped by factor analysis into synthesis/analysis, study methods, fact retention, and elaborative processing, reflecting a continuum of student information processing preferences from deep and elaborative to shallow and repetitive. Approximate administration time is 20 minutes (Cornett, 1983, p. 34).

This inventory, according to Curry (1987), measures Information Processing Style. He describes it in these ways:

> Concepts at this level describe the individual's intellectual approach to assimilating information and in that respect these concepts can be related to the classic cognitive information processing model. Information processing is a set of processes that function at the intersection between fundamental personality levels, individual differences and environmentally offered learning format choices (p. 10-11).

According to Curry (1987), strong reliability evidence and strong validity evidence (p. 40).

A refinement in conjunction with Entwistle and Ramsden of this instrument was done in 1984 (De Bello, 1988).

Swassing-Barbe Modality Index
By Walter Barbe and Raymond Swassing Columbus, Ohio: Zaner-Bloser, 1979.

(Table 20 continued)

This is a series of three tasks involving visual, auditory, and kinesthetic-tactile processing of the order of geometric shapes. It can be used with learners of any age but must be individually administered. Results tell the percentage of time each mode is used successfully. Kit includes a textbook on modality instruction and a filmstrip and tape (Cornett, 1983, p. 37).

Torrance-Your Style of Learning and Thinking Forms A & B
By Paul Torrance, Cecil R. Reynolds, T.R. Riegel, and O.E. Ball. Gifted Child Quarterly 2 (1977): 563-573.

A 36-item, self-report multiple-choice questionnaire that classifies subjects according to right hemisphere, left hemisphere, and integrated information processing. Each item presents three choices for the three modes based on an analysis of the research on brain hemispheric functioning. Approximate administration time is 20 minutes. Can be used with upper-grade students and adults (Cornett, 1983, p. 36).

There are test-retest reliabilities ranging from .84 to .47. The authors have tried to validate the test including measuring it against measures of creativity.

In a later version (1978) the instrument became a 40 item test with 3 forms, A, B, and C. It is designed for high school students and adults.

Witkin-Embedded Figures Test
By Herman A. Witkin et al. Consulting Psychologists Press Inc., 577 College Ave., Palo Alto, CA 94306, 1971.

EFT was originally designed for research with the field independent-field dependent aspect of cognitive style and used to assess analytic ability, social behavior, body concepts, etc. (Cornett, 1983, p. 34).

This inventory, according to Curry (1987), measures Information Processing Style. He describes it in these ways:

This is defined as the individual's approach to adapting and assimilating information. This is an adaptation that does not interact directly with the environment, rather these are underlying and relatively permanent

(Table 20 continued)

personality dimensions. These constructs form part of the construct description of personality (p.14-5).

According to Curry (1987), strong reliability evidence and good validity evidence (p. 46).

Witkin-Group Embedded Figures Test
By Herman A. Witkin et al. Consulting Psychologists Press Inc., 577 College Ave. Palo Alto, CA 94306.

EFT was originally designed for research with the field independent-field dependent aspect of cognitive style and used to assess analytic ability, social behavior, body concepts, etc. The GEFT is a group version of the test. Field independence and dependence characterize analytical vs. global styles of information processing. The...test takes about 15 minutes (Cornett, 1983, p. 34).

According to Curry (1987), strong reliability evidence and good validity evidence (p. 46).

(Table 20 continued)

DEFINITION INFORMATION SHEET

This is to aid you when you are using Matrix C. These definitions are the ones commonly used in the literature, however, specific inventories may have different definitions. If you have an actual inventory to evaluate, be sure to consult the inventory's manuals to see how the developer of the inventory defines specific terms.

Abstract/Concrete

[Abstract learners are] able to create concepts that integrate their observations into logically sound theories....[Concrete learners are] able to involve self fully, openly, and without bias in new experiences (Blakemore, Coker, and McCray, 1984, p. 17).

(Describes) differences in number of dimensions utilized by individuals to construe the world. A high complexity style is multidimensional and discriminating, attuned to diversity and conflict. A low complexity style prefers consistency and regularity in the environment. The former is more effective in processing dissonant information; the latter, in reconciling consonant experience (Keefe, 1979, p. 10).

Analytical/Categorical/Inferential

Learners who either analyze a situation by its individual parts or by arranging things into classes or categories or drawing conclusions not directly dirivable from the known facts.

Analytical/Global

Keefe (1982) describes field dependent/independent with these terms. (See field dependent/independent)

Anxiety Levels

Describes the individual's level of apprehension and tension under stress conditions. The highly anxious are tense and worried; the unanxious are 'cool' emotionally. A low anxious learner performs better when challenged by a difficult task, particularly when his performance will be evaluated. A high anxious learner performs less well under these same conditions (Keefe, 1979, p. 12-13).

(Table 20 continued)

Complexity/Simplicity

(Describes) differences in number of dimensions utilized by individuals to construe the world. A high complexity style is multidimensional and discriminating, attuned to diversity and conflict. A low complexity style prefers consistency and regularity in the environment. The former is more effective in processing dissonant information; the latter, in reconciling consonant experience (Keefe, 1979, p. 10).

Empathy

The ability to understand and have a vicarious experience of the thoughts and feelings of others.

Extroversion/Introversion

Staying close to the Latin, extraversion means outward-turning and introversion means inward-turning. We all do both regularly, every day. We turn outside ourselves to act in the world, and we turn into ourselves to reflect (Lawrence, 1986, p.95).

Field Dependence/Independence

Field-independent people tend to analyze the individual elements making up a task or situation; they focus upon undertakings in an analytical manner, separating items from their backgrounds. In contrast, field-dependent people tend to categorize a task or situation in a global way; they focus upon the whole, overlooking the individual elements. Put in colloquial terms, some people tend to be 'splitters' while others are 'lumpers' (Zanden & Pace, 1984, p. 115).

Focusing/Scanning

The ability of a learner to either narrow in on a central object to the exclusion of all other objects or to be able to take in several objects at one time.

Histrionics

[The] capacity to perceive expected behavior and act accordingly (Blakemore, Coker, & McCray, 1984, p. 17).

Judgment/Perception

Does the person prefer mostly to live in a decisive, planned, and orderly way, aiming to regulate and control events or in a spontaneous, flexible way, aiming to understand life and adapt to it? (Lawrence, 1982, p. 97).

(Table 20 continued)

Leader/Follower

Describes if the learner likes to head, direct and guide activities of others or is more comfortable accepting the direction and guidance of another person.

Leveling/Sharpening

[Describes] individual variations in memory processing. Levelers tend to blur similar memories and to merge new precepts readily with previously assimilated experience; they tend to over-generalize. Sharpeners are inclined to magnify small differences and to separate memory of prior experiences more easily from current data; they tend to over-discriminate (Keefe, 1979, p. 10).

Locus of Control

Locus of control refers to people's perception of who or what is responsible for the outcome of events and behaviors in their lives. As noted, people differ in the extent to which they believe that they influence the happenings in their lives. When people perceive the outcome of an action as the result of luck, chance, fate, or powerful others, they believe in external control. When individuals interpret an outcome as the consequence of their own abilities or efforts, they believe in internal control (Zander & Pace, 1984, p. 348).

Motivation

Motivation involves those inner states and processes that prompt, direct, and sustain activity....Yet, motivation is something we never directly observe. Instead, we observe people's behavior and the environment in which that behavior occurs (Zanden & Pace, 1984, p. 384).

Past/Present/Future Orientation

Describes the degree the learner relates experiences to what has happened in the past, to what is happening now, or to what he or she perceives will be happening in the future.

Persistence

[The] ability to stick to a task until completed (Blakemore, Coker & McCray, 1984, p. 18).

Persistence Orientation is the willingness to sustain behavior beyond the required time, to withstand discomfort, and to face the prospect of failure. High persistence is characterized by the disposition to work at a task until completion, seeking whatever help is needed to persevere. The low persistent learner usually

(Table 20 continued)

has a short attention span and gives up easily on demanding tasks (Keefe, 1988, p. 10).

Proxemics

[The] ability to judge appropriate physical social distance and act accordingly (Blakemore, Coker, & McCray, 1984, p. 17).

Random/Sequential

Describes how a learner makes decisions. A learner could make decisions by choosing one alternative and then another alternative without any definite pattern or by following logical steps or patterns.

Reflective/Impulsive

People, who in several problem situations in which there are alternative solutions, proceed by slow deliberation and make few errors are said to have a reflective style. Other people who test hypotheses rapidly and make many errors are said to have an impulsive style (Zanden & Pace, 1984).

Responsibility

[The] ability to follow through on a task and complete it without frequent supervision (Blakemore, Coker, and McCray, 1984, p. 18).

Self Direction/Need For Structure

(See Structure/Looseness)

Sensing/Intuition

A bipolar dimension describing an individuals' preferred manner of gathering information. Sensing refers to being more analytic and intuiting refers to being less analytic in terms of analyzing information (Blakemore, Coker & McCray, 1984, p. 17).

Serial/Simplicity

(See Abstract/Concrete)

Structure/Looseness

Need very much structure-Short attention span. Like to be active; there is constant movement....Need much structure-oriented to the role of a 'good student' one who got the right answers, had neat work and good work habits. Seek teacher approval. Want to work alone at their desks....Need less structure-Like to discuss and

(Table 20 continued)

argue....Will question and volunteer information. Want to solve things themselves....May be initially self-centered and less concerned about others (Hunt, 1979, p. 35).

Thinking/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 (Blakemore, Coker, & McCray, 1984, p. 17).

Tolerance of Ambiguity

The degree to which a learner has the ability to tolerate uncertainty or several solutions to a single problem.

Verbal/Spatial Preference

This is concept this is addressed in the NASSP Inventory. It is a subscale that measures whether a learner has a preference for verbal or spatial tasks.

(Table 20 continued)

BIBLIOGRAPHY FOR INVENTORY AND DEFINITION INFORMATION SHEETS

Blakemore, Thomas, Paul McCray, and Charles Coker. A Guide To Learning Style Assessment. Wisconsin: University of Wisconsin-Stout, 1984.

Cornett, Claudia E. What You Should Know About Teaching and Learning Styles. Bloomington, Indiana: Phi Delta Kappa Educational Foundation, 1983.

Curry, Lynn. Integrating Concepts of Cognitive or Learning Style: A Review with Attention to Psychometric Standards. Ontario: Canadian College of Health Service Executives, 1987.

De Bello, Thomas C. Comparison Of Eleven Major Learning Styles Models: Variables; Appropriate Populations; Validity of Instrumentation; and the Research Behind Them. Virginia: National Association of Secondary School Principals, 1988.

Hunt, David E. "Learning Style and Student Needs: An Introduction to Conceptual Level," Student Learning Styles Diagnosing and Prescribing Programs. Virginia: National Association of Secondary School Principals, 1979.

Keefe, James W. "Learning Style: An Overview," Student Learning Styles Diagnosing and Prescribing Programs. Virginia: National Association of Secondary School Principals, 1979.

Lawrence, Gordon. "Personality Structure and Learning Style: Uses of the Myers-Briggs Type Indicator, In Student Learning Styles and Brain Behavior, edited by NASSP. Virginia: National Association of Secondary School Principals, 1986.

Swinnen, Stephan, Joost Vandenberghe, and Erik Van Assche. "Role of Cognitive Style Constructs Field Dependence-Independence and Reflection-Impulsivity in Skill Acquisition," Journal of Sport Psychology. 8(1986), 51-69.

Zanden, James W. Vander, and Ann J Pace. Educational Psychology in Theory and Practice. New York: Random House, 1984.

If practitioners use and complete the model they should be able to:

1. Decide if they should use a cognitive/learning style inventory,
2. Determine which inventory that would best fit their needs,
3. Be able to justify why they are using a particular inventory, and
4. Have enough information to give to an administrator for the administrator to order and budget for a specific inventory.

The Flow Chart

The first step in the model is the flow chart (see Figure 3). The flow chart consists of 18 steps with 9 decision points. Practitioners using the flow chart will be directed to do computations, go to the matrices, or to use the information sheets. By using the model, practitioners should be able to decide to use a cognitive/learning style inventory, select a specific inventory to use, or decide not to use a cognitive/learning style inventory.

The Matrices

Matrix A

Matrix A (see Table 20) is the ranked and weighted list of reasons to use cognitive/learning style inventories. Each reason that the experts chose to use the inventories is on the list. The reasons are weighted using a number value (i.e."1","2") derived from the rankings given the reason by the experts. Practitioners are asked to circle the reason and corresponding number that applies to their instructional goal or goals. Then they are asked to total the numbers, and return to the flow chart. The flow chart directs the practitioners that if their numbers total 5 or more to continue in the selection process, but if the number is less than 5 to consider if other materials might be better for their purposes.

Matrix B

Matrix B (see Table 20) is a ranked list of inventories. Included in this list is the name of the inventory, the author of the inventory, and with what age groups the inventory has been used. It is arranged so that the most frequently used inventory (in this research) is first. Practitioners are asked to circle any inventories that are age appropriate for their instructional needs, and then directed to an actual inventory or the inventory information sheet to help select a specific inventory. After they have selected a specific inventory or several specific inventories that might meet their needs, they are directed back to the flow chart.

Matrix C

Matrix C (see Table 20) is a selection work sheet that includes the cognitive and technical elements selected by the experts that the experts perceived as important in cognitive/learning style inventories. This is a ranked list with the elements the experts in this study chose as the most important. The most important element appears first. Practitioners are asked to determine if a specific element or subelement is important to their instructional goals. If it is important, then the practitioners are directed to check a column labeled "important". Then using the inventory they are considering using or the inventory information sheet, the practitioners are instructed to determine if the inventory they are considering using has the checked element or subelement. If it does, they check the column labeled "yes". The practitioners add the number of checks in the column labeled "important", and then add the number of checks in the column labeled "yes". Then they divide the total in the "yes" column by the total in the "important" column to determine the percentage of the cognitive or technical areas that will be measured by a specific inventory. When they are finished dividing, they are directed back to the flow chart.

Matrix D

Matrix D (see Table 20) lists the limitations or disappointments that were selected by the experts. This is a ranked list with the greatest limitation or disappointment listed first. Practitioners are asked to check any limitation that they consider important, in column 1 labeled "important limitation", and then total all the checks. Then they are asked to look at the inventory they are going to use or look at the inventory work sheet and see if the specific inventory has the limitation they have checked. If it does not, they check column 2 labeled "limitation resolved". If the inventory has the limitation but the practitioners can determine a way(s) to overcome the limitation, then they also check "limitation resolved". If the inventory they are going to use has the limitation, and they can not resolve the limitation, then they leave column 2 blank. Then they total all the checks for column 2. Finally, the practitioners are to divide column 2 "limitations resolved" by column 1 "important limitations" to determine the percentage of limitations important to them that were resolved. When they are finished they are asked to return to the flow chart.

The Inventory Information Sheet and The Definition Information Sheet

Inventory Information Sheet

This is a sheet (see Table 20) that lists selected inventories in alphabetical order. For each inventory listed, there is a brief summary of the content of the inventory and the publisher. It might also include information about time it takes to administer the inventory, and detail other information that might help the practitioners to choose an inventory to use to meet their needs. It is included so that if practitioners can not obtain an actual inventory to preview, they can use the sheet to help determine if a specific inventory could meet their needs. It is stated on the sheet that it is preferable that they obtain the actual inventory as it will contain more information than the sheet, and the practitioners can see the format of the inventory. However, if the practitioners can not obtain a sample copy of the inventory they want to preview, they can use the inventory information sheet with the flow chart and matrices in this model.

Definition of Terms Information Sheet

This sheet (see Table 20) includes a definition of terms found in Matrix C. Although this research indicates that there is some confusion of the definition of some of these terms, this researcher has reviewed several books on cognitive/learning style and has selected definitions that are most commonly used to give practitioners some guidelines to understand what they are evaluating to use. Practitioners will be instructed to look at their specific inventory to see if the author(s) of the inventory have any definition of terms that are unique to that specific inventory.

OPINIONS, CONCLUSIONS, AND REFLECTIONS OF THE EXPERTS

In Round 3, the experts were asked to agree, disagree, and comment on their answers if they wanted to comment. These comments gave insight into the experts' thinking and gave the experts a chance to express their opinions, conclusions, and reflections on cognitive/learning styles, cognitive/learning inventories, and the Delphi research study in which they had participated.

Table 21 details the comments the experts made on the elements in cognitive/learning style inventories.

The experts ranked a list of 42 elements or characteristics of cognitive/learning style inventories (see Table 10). The relevant comments that the experts made about these rankings are listed below. Each comment represents one expert's opinion.

1. The rankings seem to consistent with the research on learning style.
2. I have no idea how to respond given a list this long.
3. While I believe cognitive skills have a substantial effect upon student achievement, I believe style is more comprehensive than just the cognitive. I would include perceptual modalities, and environmental preferences as well.
4. I've checked those that appear to be as definitions central. (Items that were checked: preference for a mode of information processing, learner's unique approach to learning, and mode of behavior used to form perceptions). Did someone actually state the last item (Defines Personality)?

The experts ranked a list of 39 reasons to use cognitive/learning style inventories (see Table 10). The relevant comments that the experts made about these rankings

Table 21

Experts Ranks and Comments On Elements In

Cognitive/Learning Style Inventories

RANK	CATEGORY
1	Inference Modalities

RANK	ELEMENT
1	field dependence/independence
2	abstract/concrete
3	self direction/need for structure
4	analytical/global
5	reflective/impulsive
6	analytical/categorical/inferential
7	verbal spatial preference
8	serial/simultaneous
9	focusing/scanning
10	complexity/simplicity
11	leveling/sharpening
12	random/sequential
13	structure/looseness

COMMENTS (Each item represents one expert's comment):

I have trouble with some of the norming procedures/data for field dependence/independence.

I agree with rank 1. I don't agree that the opposite of analytical is global. It is nonanalytical. I would place serial/simultaneous, focusing/scanning and leveling/sharpening higher up. These are cognitive skills which control the information processing system.

Not sure this block is appropriately labeled-do not consider 1 to be an inference modality-food for thought.

Field independence/dependence probably most familiar to people and does include certain dimensions listed under it.

These seem to be most important: abstract/concrete, self direction/need for structure, analytical/global.

The heart of the construct but as the results support, no distinctive descriptions emerge.

(Table 21 continued)

RANK	CATEGORY		
2	Sensory Orientations		
	RANK	ELEMENT	
	1	in a varied mode	
	2	auditory	
	3	visual	
	4	tactile	
	5	kinesthetic	

COMMENTS (Each item represents one expert's comment):

Two, three, and four should be top rank here.

My research has been with deaf subjects, so visual is their preferred sensory orientation.

I accept "varied mode" if the other items are also examined because I believe students might have some distinct preferences.

I'm more inclined to favor sensory response rather than sensory orientation. Given the present status of instrumentation, I do not believe modality preference can be measured: however, perceptual response can. (See E.L.S.I.E.)

Problem with "in varied mode"-although the statement might be partially true in some context the more specific orientations are more helpful.

Given Dunn's research I would have expected 2-5 to be reversed

If this [the preceding rankings] refers to adults not surprised. If it refers to students in grades 5-12 would have thought visual or auditory would have ranked first.

RANK	CATEGORY		
3	Affective Elements		
	RANK	ELEMENT	
	1	motivation	
	2	locus of control	
	3	persistence	
	4	sensing/intuition	
	5	thinking/feeling	
	6	tolerance of ambiguity	
	7	anxiety levels	
	8	responsibility	

(Table 21 continued)

9	judgment/perception
10	extroversion/introversion
11	leader/follower
12	proxemics
12	empathy

COMMENTS (Each item represents one expert's comment):

Not a central dimension cognitive/learning style.

Motivation is such an encompassing concept and fairly indefinite; it would seem reasonable to see it rated a little higher. I would have expected anxiety levels to be rated a little higher due to the amount of research on this phenomenon.

Rank 1 more global-the rest of the rankings more specific.

Interesting sort-not sure motivation should have been included, but there are many elements of it in 2-15.

Every child is motivated. He/she isn't always motivated to do the things we ask in school. Teaching to style helps increase motivation for school work, but it is more difficult to reverse in high school. I would choose persistence as 1 in this set.

Motivation appears to be critical.

The body of literature & research in that area needs to disseminated. I'm not sure that motivation is adequately measured via learning style instruments.

Ranked by perceived importance, or frequency of use? Clarification needed as to criteria for ranking.

Not surprised that motivation ranked so high in the list but I would not have expected it to lead by 10+ points over other top 6.

RANK	CATEGORY
4	Sociological Elements: learns best

RANK	ELEMENT
1	in a varied mode
2	with peers
3	alone
4	with authority figure
5	in mixed teams

(Table 21 continued)

COMMENTS (Each item represents one expert's comment):

Not a central factor.

Not really surprised here although as more students experience cooperative learning activities, I would expect mixed teams to be ranked higher.

In varied mode seems to be a "catch all" and is a little ambiguous in relation to the other terms. Same for "in mixed teams.

With peers-research should suggest this element equally important.

I accept "varied mode" if the number 2,3, & 4 items are also examined because I believe students might have some distinct preferences.

Surprised by split between 3 & 4. I would also rank 4 higher.

RANK	CATEGORY	
5	Physical Elements	
	RANK	ELEMENT
	1	design of learning environment
	2	time preference
	3	sound
	4	mobility
	5	light
	6	warmth

COMMENTS (Each item represents one expert's comment):

Item 1 appears to be a logical choice in that it encompasses several others. It is surprising that mobility would be rated below time & sound; I would suspect that age of the learner could be a factor.

Rank 1 more global-ranks 2 &3 more specific.

Is warmth interpreted physically? Probably an effective sort among 2-6 It would appear that other (psychological) elements (as opposed to physical) would need to be sorted out from design of learning environment.

Design of learning environment is more global than the others. Time preference would be my choice for #1 in this set.

(Table 21 continued)

These elements are the least important.

As I work with deaf subjects, sound is not applicable, but light is very important for them-especially those who lip read.

I am surprised that warmth is far down on the list. Interesting to interpret times as a physical element.

TECHNICAL

RANK	CATEGORY	
1	Inventory Administration Procedures	
	RANK	ELEMENT
	1	mixed mode
	2	written
	3	oral
	4	visual (ex. pictures, charts, models, & graphs)

COMMENTS (Each item represents one expert's comment):

If possible.

Do not understand why 3 is not preferred over 2.

A mixed mode might be appropriate but it would be very time consuming to administer.

A computer assisted mode probably will be one of the "in" approaches.

RANK	CATEGORY	
2	Manuals	
	RANK	ELEMENT
	1	should include an examiner's manual
	2	should have a scoring key
	3	examiner's manual should have bibliography
	4	should have follow up on how to get specific information on variables
	5	examiner's manual should have graphs and charts

COMMENTS (Each item represents one expert's comment):

One and two are particularly important. Other 3 would be helpful if they could be provided at little additional cost.

(Table 21 continued)

Should follow joint standards put out by AERA, NCME, and APA.

Tests need the bibliography.

I feel #1 and #2 are equally important.

Does #1 assume #2?

Surprised that 1, 2, and 3 are that far apart.

RANK		CATEGORY
3		Time Needed to Test
	RANK	ELEMENT
	1	30 min. or less
	2	15 min. or less
	3	45 min. or less
	4	60 min. or less
	5	time is unimportant
	6	2 hours or less

COMMENTS (Each item represents one expert's comment):

A trivial consideration.

I would be reluctant to use an instrument that took more than 30 minutes and one that took 15 minutes or less would probably be superficial.

Probably people using inventories want the testing to be done in a class period or have additional time to discuss the test.

Sixty minutes or less-longer test, improved reliability.

We always need to set time parameters and I do not see the reason for doing so when identifying student learning styles.

RANK		CATEGORY
4		Test Booklet
	RANK	ELEMENT
	1	should be reuseable
	2	students should be able to write in it
	3	younger students-should be able to write in it
	4	older students-should be reuseable

COMMENTS (Each item represents one expert's comment):

Trivial

(Table 21 continued)

Should be reuseable-practicality dimensions: younger students-should be able write in it and older students-should be reuseable-usability primarily: Nothing on format, directions, attractiveness, print etc.

Agree with #3 and #4.

RANK	CATEGORY	
5	Student Response to Inventory	
	RANK	ELEMENT
	1	mixed mode
	2	written
	3	visual
	4	oral
	5	movement (kinesthetic)

COMMENTS (Each item represents one expert's comment):

It would be difficult to imagine an LSI that involves movement-too time consuming and difficult to interpret.

Probably means that the test would have to be administered one to one. It would be hard to machine score a test where responses were of a different mode.

I am not sure I understand all the components of mixed mode.

A mixed mode might be appropriate but it would be very time consuming to administer.

I think written responses (#2) easiest for scoring.

RANK	CATEGORY	
6	Scoring	
	RANK	ELEMENT
	1	both should be possible (hand & machine)
	2	machine scored
	3	hand scored

COMMENTS (Each item represents one expert's comment):

All of the "technical considerations" should follow from a valid mapping of the construct. It seems to be presented as a parallel consideration.

Number one promotes most flexibility, so no surprises.

Should have included self scoring.

(Table 21 continued)

RANK	CATEGORY
7	Total Cost

RANK	ELEMENT
1	.25 or less per pupil
2	cost is unimportant
3	.26-.50 per pupil
4	.51-.75 per pupil
5	.76-1.00 per pupil

COMMENTS (Each item represents one expert's comment):

With #3, I am really surprised!

Education is always concerned with costs because our products (students) can't be priced as they do with products in the corporate world.

Cost, within reason, is unimportant. If the booklet is reuseable this may be difficult to estimate.

Extremes-not too helpful or maybe different choices ($1.00/too low).

Costs are not very realistic when you look at the cost per individual in standardized tests.

Trivial

RANK	CATEGORY
8	Manuals Should Report

RANK	ELEMENT
1	interpretation of scoring
2	inventory reliability
3	inventory validity
4	norms
5	development of inventory
6	types of validity
7	how, why, and which items are weighted
8	how it meets <u>all</u> APA standards

COMMENTS (Each item represents one expert's comment):

One, two, and three are essential.

Interesting that reliability ranked higher than validity: No statement on inclusion of case studies-interpretation probably too global.

(Table 21 continued)

Eight not too helpful except including all features from APA standards list.

I would place norms among the top 3.

The first three are very important.

are listed below. Each comment represents one expert's opinion.

1. First item is more to help the individual to understand the individual rather than the teacher or researcher.
2. GOOD-Rank 1-to help <u>individuals</u> in the learning process.
3. I accept #1. I cannot accept #2 at all! We should be conducting research but that should not be the primary use for identifying student learning styles.
4. For me, #2 (research) has been the primary purpose of cognitive style inventories.
5. Disagree #2 is research. Think other reasons are more important.

The experts ranked a list of 48 disappointments with cognitive/learning style inventories (see Table 11). The relevant comments that the experts made about these rankings are listed below. Each comment represents one expert's opinion.

1. The results tend to confirm my initial views:
   A. learning styles and cognitive styles are expressions which are essentially interchangeable,
   B. The research base of the construct(s) is <u>very</u> weak-certainly inconclusive, and
   C. To build educational programs, to advise teachers to change their practices, around the constructs of

learning and cognitive styles is very premature, misguided, and unprofessional.

2. Shows the jingle/jangle confusion we have with all psychological tests...ex. self-concept-authors define the construct differently.
3. There is need for a single paradigm of style which transcends the individual models which we now find. The NASSP Learning Style Profile is a step beyond the multiplicity of paradigms which now exist. The problem I have with most learning style instruments is the heavy reliance upon self report.
4. Do points 2 and 4 on preceding page refer to a lack of reliability, validity or a lack of information regarding reliability and validity? I think a clarification is needed.

REFLECTIONS

Each of us has his or her preferred learning style. Research has shown that if students are taught through their own preferred learning style they will have a greater likelihood of academic achievement (Dunn & Dunn, 1981). Additionally, students who are taught by teachers who have similar styles to their own develop a more positive attitude toward the subject matter and have more rapid and greater academic achievement (Drummond & McIntire, 1977; Mullally, 1977). However, few adults and even fewer children have a distinct idea of the conditions under which they learn best. Since learning style is so important, it is equally important that we know how to measure learning style. Although cognitive/learning style inventories have been in existence for at least 20 years, research to see what they should measure, how they should measure it, and even what the term cognitive/learning style means is lacking. This study was conducted as an exploratory effort to begin this research.

Having concluded this study, this researcher offers some insights regarding the data collected for this research. These reflections are contingent on feelings, hunches, and insights arising during the collection and interpretation of the data. Some or all of the conclusions discussed in this section may or may not be fully supported by the data collected. However, it is the intent of this section to assist the reader to gain insights and develop a set of questions to spur further inquiry into and about cognitive/learning style inventories.

From this research it is evident that there is considerable confusion in the field about what is cognitive/learning style, what the inventories of cognitive/learning style should measure, and what are some of the definitions of some of the terminology used for elements and subelements of cognitive/learning style. This confusion has led to questions about the validity of using cognitive/learning style inventories. Even the people who are using the inventories are aware of the variability among different instruments. Some of the practitioners and the experts in the field have given up using cognitive/learning style inventories because of this confusion. If the use of cognitive/learning style inventories is to become an important educational tool, the confusion about the definition of terms, about what a cognitive/learning style inventory measures, and about what is cognitive/learning style must be addressed.

Another issue that must be addressed in the field of cognitive/learning style, is the tendency of the public and sometimes even the teachers and the administrators to believe that one educational tool will be the panacea to solve all the educational problems. It is natural to become excited about something new and to have great expectations about the outcomes of using something new. It is important in the area of cognitive/learning style that people who are promoting this educational tool realize and point out to others it is just one tool which will aid in the process of education, not a remedy to solve all the educational problems.

One of the questions about using cognitive/learning style inventories is what does the practitioner do with the results after giving the inventories? Teachers often do not have the training to adapt their instructional practices to certain kinds of styles, and if they do have the training they do not have the time to do it in traditional types of educational settings. Adding to this problematic situation is the absence of educational materials that would address particular learning styles and the lack of flexibility of traditional educational environments. These problems must be addressed so that practitioners and students can effectively utilize the results of style inventories.

Although there are several problems that must be addressed in the field of cognitive/learning style, it is clear that learning/cognitive style inventories are an important educational tool. With the current technologies, the current educational environment, and the current knowledge there are ways to use cognitive/learning style inventories and the materials on cognitive/learning style that will enhance learning. If teachers understand their own style they will be able to adjust their style to some degree to accommodate the different learning styles of their students. This has been called "style flexing." Not only can teachers flex their own style, but they can help students to flex their styles so that they too can adapt to varying types of learning situations. If teachers know the styles of individual students, then some work can be individualized to help students, particularly those students who are having difficulty. If teachers know that the majority of the students in their classrooms learn in similar ways, then their instruction can be directed to match the style of the majority of the learners, and materials can be developed that will accommodate that style. Research on cognitive/learning style is ongoing. The current state of affairs in the field of cognitive/learning style is promising. One of its greatest strengths is that it recognizes the individual learner as unique, bringing to the learning situation his or her own set of conditions that he or she needs in order to learn best. Although most practitioners have always known that learners have unique learning strategies, often learning environments, materials, and techniques have not reflected these differences. The research on cognitive/learning style reminds us, as practitioners, to be aware of and to respond to the individual differences of learners.

SUMMARY

In this chapter the researcher presented the summary, conclusions, and recommendations for this research. A reiteration of the research purpose was set forth. Then a summary of Chapters 1 through 4 was given.

The presentation of findings, results, conclusions, and recommendations for the 5 research questions were presented. For Question 1, the top 10 cognitive/learning style inventories, as selected by the experts in this study, were identified. For Question 2, it was determined that the experts could identify a set of elements that they perceived to differentiate effectively and efficiently among widely used inventories. For Question 3, the experts in this study, ranked the elements that were selected in Question 2 in order to determine their relative importance. A consensus was reached for individual elements ranging from 82.14% to 96.43% For Question 4, the top 5 elements that the experts in this study perceived to be important in inventories of cognitive/learning style were listed. A 96.42% consensus was reported. For Question 5, the top 5 reasons to use and the top 5 disappointments with cognitive/learning style inventories were listed. A 89.29% consensus was reported for both lists. Specific recommendations were listed for each question, however, the general recommendation for all questions was that this study needs to be replicated with a larger sample that includes practitioners as well as experts in the field.

The model for practitioners that was developed from this research was outlined. The parts of the model (the flow chart, the matrices, and the information sheets) were discussed.

Comments of the experts for Questions 3, 4, and 5 were listed. This researcher reflected on some insights gained in the process of doing this research. It was stated that these insights might or might not be fully supported by the data collected in this research. Some of the issues addressed in this section were:

1. The confusion in the field about what is cognitive/learning style,
2. The issue of what cognitive/learning style should measure,
3. The unclear definition of terms of the elements

in inventories of cognitive/learning style,

4. The tendency to see a specific educational innovation such as cognitive/learning style as a panacea to all the educational problems, and

5. The absence of classroom applications in the manuals of cognitive/learning style inventories, and

6. The lack of educational materials so that teachers can adjust their teaching methods to different styles.

Current ways and reasons to use cognitive/learning style were discussed. "Style flexing" as a way to adjust learning and teaching to different styles is outlined. The use of cognitive/learning style as a way to acknowledge and adjust to the uniqueness of each individual learner was stated. Finally, a summary of Chapter 5 was presented.

APPENDICES

APPENDIX A

ROUND 1 DELPHI QUESTIONNAIRE

ROUND 1 DELPHI QUESTIONNAIRE

COGNITIVE, LEARNING, AND EDUCATIONAL INVENTORIES

DIRECTIONS

The column on the far left lists the inventories in alphabetical order according the author's last name.
The second column asks you to respond with a "U" if you have used a particular inventory, or an "F" if you have not used it but are very familiar with it.
The third column asks you what grades with which you have used the inventory. There are 5 categories. You may have more than one response in this column.
The last column on the far right asks when you used the inventory last.
A sample,"EXAMPLE INVEN." is provided below: Note how responses might be made. At the end there are some empty columns. They are there for you to **ADD ANY INVENTORIES THAT ARE NOT HERE that you have used or with which you are very familiar.** If you need additional space use the back of the page.

INVENTORY	USED (U) VERY FAMILIAR	AGE RANGES PRESCHOOL (P) GRADES K-5 (E) GRADES 6-8 (M) GRADES 9-12(H) ADULT (A)	LASTDATE USED
EXAMPLE INVEN.	U	M,H	PRESENTLY
Canfield-Learning Style Inventory			
Dunn, Dunn, & Price Learning Style Inventory			
French, Ekstrom & Price-Hidden Figures Test			
Gregorc-Transaction Ability Inventory			
Hill-Cognitive Style Interest Inventory			
Kagan-Matching Familiar Figures Test			
Keefe-NASSP Learning Style Profile			

INVENTORY	USED (U) VERY FAMILIAR	AGE RANGES PRESCHOOL (P) GRADES K-5 (E) GRADES 6-8 (M) GRADES 9-12(H) ADULT (A)	LAST DATE USED
Kolb-Learning Style Inventory			
Letteri-Cognitive Profiles			
Myer & Briggs Myer-Briggs Type Indicator			
Papalia-Learning Modalities			
Reinert-Edmonds Edmonds Learning Style Inventory			
Renzulli & Smith Learning Style Inventory			
Schmeck-Inventory of Learning Processes			
Sigel-Test of Conceptual Style			
Torrance-Your Style of Learning & Thinking			
Witkin-Embedded Figures Test			
Witkin-Group Embedded Figures Test			

DIRECTIONS

Cognitive, learning and\or educational inventories measure one or more cognitive elements. Below is a list of some cognitive elements measured by the different inventories. If you feel that any element should be measured by an inventory, please mark it with an "X". You may put "X"s by all, some or none of the items. Do not be concerned with ranking the elements which you check. At the bottom or back of the page, **LIST ANY OTHER ELEMENTS WHICH YOU THINK SHOULD BE MEASURED** in a learning, cognitive and/or educational inventory.

PHYSICAL ELEMENTS

_____sound _____mobility _____light

_____warmth _____time preference _____design of learning environment

AFFECTIVE ELEMENTS

_____motivation _____persistence

_____responsibility _____sensing/intuition

_____thinking/feeling _____extroversion/ introversion

_____judgment/perception _____anxiety levels

_____tolerance of ambiguity _____locus of control

_____leader/follower _____past/present/future orientation

SOCIOLOGICAL ELEMENTS

Learns best:

_____with peers _____with authority figure

_____alone _____in mixed teams

_____in a varied mode

SENSORY ORIENTATION

_____auditory _____visual _____tactile

_____kinesthetic _____in a varied mode

INFERENCE MODALITIES

_____field dependence/independence _____reflective/impulsive

_____complexity/simplicity _____leveling/sharpening

_____serial/simultaneous _____abstract/concrete

_____random/sequential _____structure/looseness

ADDITIONAL COGNITIVE ELEMENTS

DIRECTIONS

Most cognitive, learning and/or educational style inventories have manuals that provide technical information about the inventory such as reliability, format, manuals, paper quality, etc. Below is a list of technical elements that might be found with an inventory. Please put an "X" by any element that you feel is important. ADD ANY OTHER ELEMENTS THAT YOU CONSIDER IMPORTANT AT THE BOTTOM OF THE LIST AND/OR THE BACK OF THE PAPER. You may put "X"s by all, some, or none of the items.

Time needed to test

_____15 min. or less _____60 min. or less

_____30 min. or less _____2 hrs. or less

_____45 min. or less _____time is unimportant

Test Booklet

_____should be reuseable _____students should be able to write in it

Total Cost (Scoring, Booklet, Score Sheets)

_____ .25 or less per pupil _____.76-1.00 per pupil

_____.26-.50 per pupil _____1.01-2.00 per pupil

_____.51-.75 per pupil _____Cost is unimportant

Manuals

_____should include an examiner's manual

_____Examiner's manual should have graphs and charts

_____Examiner's manual should have a bibliography

Manuals should report

_____development of inventory _____inventory validity

_____inventory reliability _____interpretation of scoring

Inventory Administration Procedures

_______oral

_____visual (ex. pictures, charts,models & graphs)

_____written

_____mixed mode

Scoring

_____ hand scored

_____ machine scored

Student Response to Inventory

_____written

_____oral

_____visual

_____movement (kinesthetic)

_____mixed mode

DIRECTIONS

The next five questions are open-ended questions.
The first three open-ended questions ask for definitions. If you believe that any of these terms are the same, please define the first term and write same as (put in the term that you feel it is the same as) for the second or third term. If you feel unprepared to define any term, please draw a line (______). Please **DO NOT LEAVE BLANK SPACES.**
The last two open-ended questions ask about cognitive, learning, and/or educational style inventories. If you feel unprepared to answer any question, please draw a __________. Please **DO NOT LEAVE BLANK SPACES.** If you need more room, you can use the bottom or back of the page.

DEFINITIONS

Learning Style

Cognitive Style

Educational Style

Inventories

The reason(s) I use or have used the inventories is (are)

My disappointment(s) when using the inventories is (are)

APPENDIX B

SELECTED PARTS OF ROUND 2 DELPHI QUESTIONNAIRE

SELECTED PARTS OF ROUND 2 DELPHI QUESTIONNAIRE*

DIRECTIONS

Below are the responses you chose on Round I. In each block you have 10 POINTS. Distribute your points so that the greatest amount of points goes to the element(s) that you think are the most important, and the least amount of points goes to the element(s) that you feel are the least important. Some elements within a block can have the same amount of points , "0" (zero) points or one element in a block can have all 10 points. Use only whole numbers.

For Example:

CHARACTERISTICS OF A LIVING HORSE

Block 1

Uses for a horse

__4__Pet __0__To do higher math __0__For sport

__4__To ride __2__Breeding

TOTAL__10__=10

Block 2

Physical

__0__Has 4 legs __0__Is brown __10__Has a heart

__0__Has a tail

TOTAL__10__=10

*Some definitions and questions were unfamiliar to most of the respondents or resulted in answers that duplicated other answers or answers that did not address the research questions. These items were left out of this appendix, but can be obtained by contacting this researcher.

COGNITIVE ELEMENTS OF LEARNING/COGNITIVE/EDUCATIONAL STYLE

Block 1

PHYSICAL ELEMENTS

_____sound _____mobility _____light

_____warmth _____time preference _____design of learning environment

TOTAL_____=10

Block 2

AFFECTIVE ELEMENTS

_____motivation

_____responsibility

_____thinking/feeling

_____judgment/perception

_____tolerance of ambiguity

_____leader/follower

_____Proxemics

_____Histrionics

_____persistence

_____sensing/intuition

_____extroversion/ introversion

_____anxiety levels

_____locus of control

_____past/present/future orientation

_____Empathy

TOTAL_____=10

Block 3

SOCIOLOGICAL ELEMENTS

Learns best:

_____with peers

_____alone

_____in a varied mode

_____with authority figure

_____in mixed teams

TOTAL_____=10

Block 4

SENSORY ORIENTATION

_____auditory	_____visual	_____tactile
_____kinesthetic	_____in a varied mode	

TOTAL_____=10

Block 5

INFERENCE MODALITIES

_____field dependence/independence	_____reflective/impulsive
_____complexity/simplicity	_____leveling/sharpening
_____serial/simultaneous	_____abstract/concrete
_____random/sequential	_____structure/looseness
_____analytical/global	_____analytical/categorical/inferential
_____self direction/need for structure	_____focusing/scanning
_____verbal/spatial preference	

TOTAL_____=10

DIRECTIONS

Below are the responses you chose in Round 1. In each block you have 10 POINTS. Distribute your points so that the greatest amount of points goes to the element(s) that you think is/are the most important, and the least amount of points goes to the element(s) that you feel is/are the least important. Some elements within a block can have the same amount of points, "0" (zero) points, or 1 element in a block can have all 10 points. Use only whole numbers.

TECHNICAL ELEMENTS

Block 1

Time needed to test (for most purposes)

_____15 min. or less

_____30 min. or less

_____45 min. or less

_____60 min. or less

_____2 hrs. or less

_____time is unimportant

TOTAL_____=10

Block 2

Test Booklet

_____should be reuseable

_____younger students should be able to write in it

_____students should be able to write in it

_____older students it should be reuseable

TOTAL_____=10

Block 3

Total Cost (Scoring, Booklet, Score Sheets)

_____ .25 or less per pupil

_____.26-.50 per pupil

_____.51-.75 per pupil

_____.76-1.00 per pupil

_____1.01-2.00 per pupil

_____Cost is unimportant

TOTAL_____=10

Block 4

Manuals

_____should include an examiner's manual

_____Examiner's manual should have graphs and charts

_____Examiner's manual should have a bibliography

_____should have a scoring key

_____should have follow up on how to get specific information on variables

TOTAL_____=10

Block 5

Manuals should report

_____development of inventory

_____inventory reliability

_____norms

_____types of validity

_____inventory validity

_____interpretation of scoring

_____how, why and which items are weighted

TOTAL_____=10

Block 6

Inventory Administration Procedures

______oral

_____written

_____visual (ex. pictures, charts,models & graphs)

_____mixed mode

TOTAL_____=10

Block 7

Scoring

_____ hand scored

_____ machine scored

_____both should be possible

TOTAL_____=10

Block 8

Student Response to Inventory

_____written _____oral

_____visual _____movement (kinesthetic)

_____mixed mode

TOTAL_____=10

ADDITIONAL TECHNICAL ELEMENTS

DIRECTIONS

In each block please distribute 10 points. Give the category that you think is the most important the most points, and the category that you think is the least important the least points. You may chose to give one category all your points or none of your points. Two categories may have the same amount of points as long as the total adds up to 10. Use only whole numbers.

Block 1

Cognitive categories of learning/cognitive/educational style (If you are unsure what these are, please see the preceding pages in this Delphi for examples)

_____Physical elements

_____Affective elements

_____Sociological elements

_____Sensory orientations

_____Inference modalities

TOTAL_____=10

Block 2

Technical categories of learning/cognitive/educational style (If you are unsure what these are, please see the preceding pages in this Delphi for examples)

_____Time needed to test

_____Test booklet

_____Total cost

_____Manuals

_____Manuals should report

_____Inventory administration procedures

_____Scoring

_____Student response to inventory

TOTAL_____=10

DIRECTIONS
CHARACTERISTICS OF LEARNING/COGNITIVE/EDUCATIONAL STYLE INVENTORIES

These are the characteristics you have identified in the first round. The answers have been consolidated. Decide which ones you feel would be important in any definition of learning/cognitive/educational style inventories. Some are very close in wording, but have slightly different meanings. So, carefully choose the ones that best express how you would define learning/cognitive/educational style inventories. Put "X"s in the spaces closest to the characteristics you have chosen. Then using 25 points distribute points among your "X"s. Give the greatest amount of points to the most important "X"'d characteristic of style inventories. and the smallest amount of points to least important "X"'d characteristic of style inventories. Two or more "X"s may get the same number of points. All numbers must be whole numbers. Those characteristics not "X"d automatically get "0" (zero) points.

For Example:

CHARACTERISTICS OF A GOOD ELEMENTARY TEACHER

____	____	Good looking	15	X	Likes children
2	X	Is organized	4	X	Has a well rounded education
____	____	Wears good clothes	4	X	Communicates well

__2__ SUBTOTAL COL. 1 __23__ SUBTOTAL COL. 2

Subtotal Col.1 __2__

Subtotal Col. 2 __23__

TOTAL __25__ =25

LEARNING/COGNITIVE/EDUCATIONAL STYLE INVENTORIES

___ ___ Assessment tool for preferences

___ ___ A reporting of factors that influence a person's social interactions

___ ___ Assessment tool for attitudes

___ ___ Organized lists of elements necessary for the acquisition of a skill or completion of a task

___ ___ A series of questions designed to assess preferences of learners

___ ___ Perceptions

___ ___ Assessment tool for personality attributes

___ ___ A reporting of factors that influence affective behavior

___ ___ A series of processing tasks to assess learners' strengths and weaknesses

___ ___ A reporting of factors that influence an individual's achievement

___ ___ Assessment devices that statistically represents an element(s) in learning

___ ___ A series of questions designed to assess learners' strengths and weaknesses

___ ___ Records of performances

___ ___ Records of preferences

___ ___ Defines personality

___ ___ Defines motivation constructs

___ ___ Self assessment

___ ___ Usually self reported

___ ___ Checklist of items

___ ___ Group administered

___ ___ Formats include checklist, paired comparisons, or scales

___ ___ Usually a paper and pencil activity

___ ___ Can be tactile

___ ___ Self perceptions

___ ___ Behavioral models possible

___ ___ Made of self reports or observations

___ ___ Can be oral

___ ___ Method of collecting information about learning styles in an informal way

___ ___ Instruments used to categorize individuals

___ ___ Instruments used to measure identified concepts and constructs

___ ___ Instruments which diagnose learning styles

___ ___ Records of behaviors

___ ___ Measuring tools

___ ___ Instruments used to group individuals

___ ___ Measuring device

___ ___ A form

___ ___ Tests

___ ___ A systematic process of collecting data

___ ___ Survey of attitudes

___ ___ Survey of preferences

___ ___ Inexpensive

___ ___ Quick to use

___ ___ Easy to use

DIRECTIONS
REASONS TO USE
LEARNING/COGNITIVE/EDUCATIONAL STYLE INVENTORIES

These are the reasons to use learning/cognitive/educational style inventories that you have identified in the first round. The answers have been consolidated. Decide which ones you feel would be important in any list of reasons to use style inventories. Some are very close in wording, but have slightly different meanings. So, carefully choose the ones that best express your viewpoint about why you would use style inventories. Put "X"s in the spaces closest to the characteristics you have chosen. Then using 25 points distribute points among your "X"s. Give the greatest amount of points to the most important "X"'d reason to use, and the smallest amount of points to least important "X"'d reason to use. Two "X"s may get the same number of points. All numbers must be whole numbers. Those characteristics not "X"d automatically get "0" (zero) points.

For Example:

CHARACTERISTICS OF A GOOD ELEMENTARY TEACHER

_____ _____Good looking __15__ __X__Likes children

__2__ __X__Is organized __4__ __X__Has a well rounded education

_____ _____Wears good clothes __4__ __X__Communicates well

__2__SUBTOTAL COL. 1 __23__SUBTOTAL COL. 2

Subtotal Col.1 __2__

Subtotal Col. 2 __23__

TOTAL __25__ =25

REASONS TO USE LEARNING/COGNITIVE/EDUCATIONAL STYLE INVENTORIES

___ ___ To predict learning

___ ___ To help make diagnosis

___ ___ To predict the success of independent study students

___ ___ To do research

___ ___ To determine the psychometric properties of the inventories

___ ___ To satisfy intellectual curiosity

___ ___ To pinpoint individual differences that correlate with student behaviors

___ ___ To supplement IQ tests

___ ___ To pinpoint individual differences that correlate with teacher behaviors

___ ___ To discriminate performance differences

___ ___ To assess children's skills

___ ___ To help college students learn how they learn

___ ___ To find out how learners perceive their achievements

___ ___ To help the self actualization process

___ ___ To help college students learn about themselves

___ ___ To assess how learners perceive their own behavior

___ ___ To teach teachers how maximize their teaching

___ ___ To remind teachers of the diversity of any group of learners

___ ___ To help to ensure that learning occurs without gaps

___ ___ To aid in structuring educational augmentation programs

___ ___ To determine how to diversify learning materials

___ ___ To provide a framework to critique traditional teaching methods

___ ___ To get a historical view of how conditions affect learning preferences

___ ___ To personalize education

___ ___ To find out if students' learning styles respond to teachers' teaching styles

___ ___ To investigate if developmental conditions affect learning preferences

___ ___ To assess how teachers perceive their own behavior

___ ___ In order to investigate how different brain treatments enhance learning

___ ___ To check on the consistency of patterns among various learning theories

___ ___ Because they are valid

___ ___ Because they are time efficient

___ ___ Because they are easy to administer

___ ___ Because they are reliable

___ ___ Because they are efficient

___ ___ Because of the reasonable cost

___ ___ To help advisors work with individual students

___ ___ To determine learners' strengths

___ ___ To find the strengths of a majority of learners in a given situation

___ ___ To address learning problems

___ ___ To find ways to help students

___ ___ To help make student placements

___ ___ To determine cognitive style

___ ___ To determine a general picture of the learner

___ ___ To help <u>individuals</u> in the learning process

DIRECTIONS
DISAPPOINTMENTS WITH
LEARNING/COGNITIVE/EDUCATIONAL STYLE INVENTORIES

These are the disappointments you have had when you used learning/cognitive/educational style inventories. The answers have been consolidated. Decide which ones you feel would be important in any list of disappointments about using learning/cognitive/educational style inventories. Some are very close in wording, but have slightly different meanings. So, carefully choose the ones that best describes your disappointments. Put "X"s in the spaces closest to the characteristics you have chosen. Then using 25 points distribute points among your "X"s. Give the greatest amount of points to the most important "X"'d disappointment, and the smallest amount of points to the least important "X"'d disappointment. Two or more characteristics may get the same number of points. All numbers must be whole numbers. Those disappointments not "X"d automatically get "0" (zero) points.

For Example:

CHARACTERISTICS OF A GOOD ELEMENTARY TEACHER

_____ _____Good looking __15__ __X__Likes children

__2__ __X__Is organized __4__ __X__Has a well rounded education

_____ _____Wears good clothes __4__ __X__Communicates well

__2__SUBTOTAL COL. 1 __23__SUBTOTAL COL. 2

Subtotal Col.1 __2__

Subtotal Col. 2 __23__

TOTAL __25__=25

DISAPPOINTMENTS WITH LEARNING/COGNITIVE/EDUCATIONAL STYLE INVENTORIES

___ ___ Not consistent

___ ___ Variations in different inventories of definitions of learning style

___ ___ Amount of overlap in different instruments

___ ___ Too simplistic

___ ___ Preference focus is superficial

___ ___ Measures too few variables

___ ___ Too general

___ ___ No information on how area being tested relates to other aspects of learning style

___ ___ Lack of cognitive measures for elementary students

___ ___ Not comprehensive

___ ___ Prescriptive nature of manuals

___ ___ Skimpy manuals

___ ___ No manuals on some

___ ___ Lack of interpretation

___ ___ Poor development

___ ___ Lack of information on the development of the inventory

___ ___ Ignores findings of experimental psychology

___ ___ Lack of empirical evidence

___ ___ Lacks a thorough grounding in experimental psychology

___ ___ Not well researched

___ ___ Lack of variability in administration procedures

___ ___ Many need to be sent out to be scored

___ ___ The use mainly of a checklist

___ ___ Too cumbersome

___ ___ Self reporting among children is unreliable

___ ___ Reassessment too time consuming

___ ___ Time to administer

___ ___ Scoring is difficult

___ ___ Ipsative scoring scales

___ ___ Too few items in each category

___ ___ Too much self reporting

___ ___ Poor direction on how to apply results to the classroom

___ ___ Measures elements which teachers have little or no control

___ ___ Conceptual orientation

___ ___ Lack of resources to match determined style with learners' style

___ ___ Misnomer-designed to measure ability not style

___ ___ Lack of direction for teachers on how to make choices about which instrument to use

___ ___ No theoretical base

___ ___ Honesty of self reporting

___ ___ Difficulty of monitoring group testing

___ ___ Too expensive

___ ___ Lack of documentation of effectiveness of inventory

___ ___ Lack of validity

___ ___ Too high of a correlation with measures of IQ

___ ___ Lack of reliability

___ ___ Leads to unwarranted conclusions because of lack of validity

___ ___ Measures for primary children ineffective

___ ___ Poor norming

___ ___ Not enough consistency across dimensions

___ ___ Lack of norms for the handicapped

APPENDIX C

SELECTED PARTS OF ROUND 3 DELPHI QUESTIONNAIRE

COVER LETTER AND SELECTED PARTS* OF

ROUND 3 DELPHI QUESTIONNAIRE

924 B Cherry Lane
E. Lansing, MI 48823
(517) 355-8229
Oct. 19, 1990

Dear Dr.

Here is the <u>last</u> Delphi Survey on Cognitive/Learning Style Inventories in which you have been participating. Please read the results and make appropriate comments if desired in the spaces provided. If you agree with all the rankings, you do not have to make any comments. However whether you make comments are not, please return the survey. <u>Note</u>: A ranking of "1" indicates the element or characteristic that received the most points as determined by the respondents. In addition, a line of asterisks dividing two rankings means that there are more than 10 points separating those two rankings.

The summaries that are included in this mailing are the major results of this study. I will send you a short summary of this round. Please return this round as soon as possible. Already the results provide insights into the area of cognitive/learning style inventories. It is anticipated that this final round will help to bring closure to this Delphi and further enhance our understanding of cognitive/learning style inventories. Please feel free to call me collect if you have any questions.

Thank you for your patience and assistance with this project.

Sincerely,

Diane Genshaw

*Some definitions and questions were unfamiliar to most of the respondents or resulted in answers that duplicated other answers or answers that did not address the research questions. These items were left out of this appendix, but can be obtained by contacting this researcher.

COGNITIVE ELEMENTS OF LEARNING/ COGNITIVE/EDUCATIONAL STYLE

Block 1

PHYSICAL ELEMENTS

RANK	ELEMENT
1	design of learning environment
***	
2	time preference
3	sound
***************	
4	mobility
5	light
***************	
6	warmth

COMMENTS:

Block 2

AFFECTIVE ELEMENTS

RANK	ELEMENT
1	motivation
********************	
2	locus of control
3	persistence
4	sensing/intuition
5	thinking/feeling
6	tolerance of ambiguity
7	anxiety levels
8	responsibility
9	judgment/perception
10	extroversion/introversion
11	leader/follower
12	proxemics
12	empathy
14	histrionics
15	past/present/future orientation

COMMENTS:

Block 3

SOCIOLOGICAL ELEMENTS
Learns best:

RANK	ELEMENT
1	in a varied mode
2	with peers
3	alone
***************	
4	with authority figure
5	in mixed teams

COMMENTS:

Block 4

SENSORY ORIENTATION

RANK	ELEMENT
1	in a varied mode
**************************	
2	auditory
3	visual
****************	
4	tactile
5	kinesthetic

COMMENTS:

Block 5

INFERENCE MODALITIES

RANK	ELEMENT
1	field dependence/independence
2	abstract/concrete
3	self direction/need for structure
4	analytical/global
5	reflective/impulsive
6	analytical/categorical/inferential
7	verbal/spatial preference
8	serial/simultaneous
9	focusing/scanning
10	complexity/simplicity
11	leveling/sharpening
12	random/sequential
13	structure/looseness

COMMENTS:

**TECHNICAL ELEMENTS OF LEARNING/
COGNITIVE/EDUCATIONAL STYLE**

Block 1

TIME NEEDED TO TEST(for most purposes)

RANK	ELEMENT
1	30 min. or less
*************************	
2	45 min. or less
3	60 min. or less
4	15 min. or less
*************************	
5	time is unimportant
*****************************	
6	2 hrs. or less

COMMENTS:

Block 2

TEST BOOKLET

RANK	ELEMENT
1	should be reuseable
******************************	
2	students should be able to write in it
**	
3	younger students-should be able to write in it
4	older students-should be reuseable

COMMENTS:

Block 3

TOTAL COST (Scoring, Booklet, Score Sheets)

RANK	ELEMENT
1	.25 or less per pupil
2	cost is unimportant
*****************************	
3	.26-.50 per pupil
4	.76-1.00 per pupil
5	.51-.75 per pupil
***************************	
6	1.01-2.00 per pupil

COMMENTS:

Block 4

MANUALS

RANK	ELEMENT
1	should include an examiners manual
**	
2	should have a scoring key
************************************	
3	examiner's manual should have bibliography
**	
4	should have follow up on how to get specific information on variables
5	examiner's manual should have graphs and charts

COMMENTS:

Block 5

MANUALS SHOULD REPORT

RANK	ELEMENT
1	interpretation of scoring
2	inventory reliability
3	inventory validity
*****************************	
4	norms
5	development of inventory
6	types of validity
****************************	
7	how, why, and which items are weighted
8	how it meets <u>all</u> APA standards

COMMENTS:

Block 6

INVENTORY ADMINISTRATION PROCEDURES

RANK	ELEMENT
1	mixed mode
*********************	
2	written
******************	
3	oral
4	visual (ex. picture, charts, models, & graphs)

COMMENTS:

Block 7

SCORING

RANK	ELEMENT
1	both should be possible (hand & machine)
**	
2	machine scored
************************	
3	hand scored

COMMENTS:

Block 8

STUDENT RESPONSE TO INVENTORY

RANK	ELEMENT
1	mixed mode
********************	
2	written
*****************	
3	visual
4	oral
5	movement (kinesthetic)

COMMENTS:

COGNITIVE AND TECHNICAL CATEGORIES OF LEARNING/ COGNITIVE/EDUCATIONAL STYLE INVENTORIES

(If you are unsure what these are, please see the preceding pages in this Delphi for examples.)

Block 1

COGNITIVE CATEGORIES

RANK	CATEGORY
1	inference modalities
******************************	
2	sensory orientations
3	affective elements
****************************	
4	sociological elements
5	physical elements

COMMENTS:

Block 2

TECHNICAL CATEGORIES

RANK	CATEGORY
1	inventory administration procedures
2	manuals
3	time needed to test
4	test booklet
5	student response to inventory
6	scoring
7	total cost
8	manuals should report (describes inventory reliability, validity, development, norms, interpretation, and weighting)

COMMENTS:

PLEASE CONTINUE TO THE NEXT PAGE

CHARACTERISTICS OF LEARNING/COGNITIVE STYLE INVENTORIES

RANK	CHARACTERISTIC
1	instruments which diagnose learning styles
**********	**
2	a series of questions designed to assess preferences of learners
**********	**
3	assessment tool for preferences
4	a series of processing tasks to assess learners' strengths and weaknesses
**********	**
5	survey of preferences
6	usually a paper and pencil activity
7	instruments used to measure identified concepts and constructs
8	assessment tool for personality attributes
9	measuring device
10	records of preferences
11	a reporting of factors that influence an individual's achievement
12	perceptions
13	assessment devise that statistically represents an element(s) in learning
14	a systematic process of collecting data
15	method of collecting information about learning styles in an informal way
16	usually self reported
17	instruments used to categorize individuals
18	self assessment
19	a series of questions designed to assess learners' strengths and weaknesses
20	tests
21	self perceptions
22	assessment tool for attitudes
23	organized lists of elements necessary for the acquisition of a skill or completion of a task
24	group administered
24	easy to use
26	inexpensive
27	records of performance
28	can be tactile
28	can be oral
28	quick to use
31	made of self reports or observations
32	checklist of items
33	a reporting of factors that influence a person's social interactions
34	a reporting of factors that influence affective behavior
35	formats include checklist, paired comparisons, or scales
36	instruments used to group individuals

SEE THE BACK OF THIS PAGE FOR THE REST OF THE LIST

RANK	CHARACTERISTIC
36	defines motivation constructs
38	survey of attitudes
39	records of behaviors
40	a form
40	behavioral models possible
42	defines personality

COMMENTS:

REASONS TO USE LEARNING/COGNITIVE/EDUCATIONAL STYLE INVENTORIES

RANK	REASON
1	to help individuals in the learning process
**	
2	to do research
3	to provide a framework for designing new teaching methods
3	to find out if students' learning styles respond to teachers' teaching styles
5	to determine how to diversify learning materials
6	to determine cognitive style
7	to determine learners' strengths
8	to pinpoint individual differences that correlate with student behaviors
9	to teach teachers how to maximize their teaching
10	to address learning problems
11	to predict learning
12	to pinpoint individual differences that correlate with teacher behaviors
13	to personalize education
14	to determine learners' weaknesses
15	to find ways to help students
16	to help make diagnosis
17	to help college students learn how they learn
18	to determine a general picture of the learner
19	to remind teachers of the diversity of any group of learners
20	to aid in structuring educational augmentation programs
21	to help in the self actualization process
22	to access how learners' perceive their own behavior
23	to provide a framework to critique traditional teaching methods
24	to help advisors work with individual students
25	to determine the psychometric properties of the inventories
26	to satisfy intellectual curiosity
27	to find the strengths of a majority of learners in a given situation
28	to investigate if developmental conditions affect learning preferences
29	to supplement IQ tests
30	to discriminate performance differences
30	to assess how teachers' perceive their own behavior
32	to predict the success of independent study students
33	to assess children's skills
34	to help ensure that learning occurs without gaps
35	in order to investigate if different brain treatments enhance learning

SEE THE BACK OF THIS PAGE FOR THE REST OF THE LIST

RANK	USE
36	to help college students learn about themselves
37	because they are valid
38	to help make student placements
39	to check on the consistency of patterns among various learning theories

Responses receiving "0" (zero) points
to find out how learners' perceive their achievements
because they are time efficient
because they are easy to administer
because they are reliable
because of the reasonable cost
to get a historical view of how learning conditions affect learning preferences

COMMENTS:

DISAPPOINTMENT WITH LEARNING/COGNITIVE/ STYLE INVENTORIES

RANK	DISAPPOINTMENT
1	variations in different inventories of definitions of learning style
**********	**
2	lack of validity
3	poor direction on how to apply results to classroom
4	lack of reliability
5	too simplistic
6	no classroom application in manuals
6	measures elements which teachers have little or no control
8	lack of cognitive measures for elementary students
9	leads to unwarranted conclusions because of lack of validity
10	lack of empirical evidence
11	preference focus is superficial
12	no information on how area being tested relates to other aspects of learning style
13	not well researched
14	lack of documentation of effectiveness of inventory
15	lacks a through grounding in experimental psychology
15	poor norming
15	lack of norms for the handicapped
18	no theoretical base
18	lack of information on development of inventory
20	lack of interpretation
21	not consistent
21	skimpy manuals
21	measures for primary children ineffective
24	no manuals on some
24	too much self reporting
24	honesty of self reporting
27	self reporting among children is unreliable
27	scoring is difficult
29	lack of direction for teachers on how to make choices about which instrument to use
30	too few items in each category
31	many need to be sent out to be scored
32	prescriptive nature of manuals
32	poor development
32	too expensive
35	too high of correlation with measures of IQ
36	reassessment too time consuming
37	measures too few variables
37	too general
37	ignores findings of experimental psychology
37	not enough consistency across dimensions

SEE THE BACK OF THIS PAGE FOR THE REST OF THE LIST

RANK	DISAPPOINTMENT
41	the use mainly of a checklist
42	not comprehensive
43	misnomer-designed to measure ability not style
44	ipsative scoring scales
45	too cumbersome
46	difficulty of monitoring group testing
47	amount of overlap in different instruments
47	lack of variability in administration procedures

Responses receiving "0" (zero) points
conceptual orientation
time to administer

COMMENTS:

BIBLIOGRAPHY

BIBLIOGRAPHY

American Psychological Association. Standards for Educational and Psychological Testing. Washington, D.C.: American Psychological Association, 1985.

Bentov, Itzhak. Stalking the Wild Pendulum. New York: E.P. Dutton, 1977.

Blakemore, Thomas, Paul McCray, and Charles Coker. A Guide to Learning Style Assessment. Wisconsin: University of Wisconsin-Stout, 1984.

Borg, Walter R., and Meredith Damien Gall. Educational Research An Introduction. New York: Longman Inc., 1979.

Briggs, Leslie J., and Walter W. Wager. Handbook of Procedures for the Design of Instruction. Englewood Cliffs, New Jersey: Educational Technology Publications, 1980.

Bruner, Jerome S., and Leo Postman. "Perception, Cognition, and Behavior." Journal of Personality 18(Sept. 1949):14-31.

Bruner, Jerome. The Process of Education. Massachusetts: Harvard University Press, 1978.

Carbo, Marie. "Research in Reading and Learning Style: Implications for Exceptional Children," Exceptional Children 49 (April 1983): 486-94.

Clarke, Ronald F., ed. Perspectives On Learning. Manchester: University of Manchester, 1982.

Cohen, Rosalie. "The Relationship between Socio-Conceptual Styles and Orientation to School Requirements," Sociology of Education 41 (Spring 1968): 201-28.

Coop, Richard H. and Irving Sigel. "Cognitive Style: Implications For Learning and Instruction," Psychology in the Schools 8 (1971): 152-161.

Coop, Richard H. and Laurence D. Brown. "Effects of Cognitive Style and Teaching Method On Categories of Achievement," Journal of Educational Psychology 61 (1970): 400-405.

Cornett, Claudia E. What You Should Know About Teaching and Learning Styles. Bloomington, Indiana: Phi Delta Kappa Educational Foundation, 1983.

Cotterell, John L. "Matching Teaching to Learners: A Review of a Decade of Research." Psychology in the Schools 19 (1982): 106-12.

Curry, Lynn. Integrating Concepts of Cognitive or Learning Style: A Review with Attention to Psychometric Standards. Ontario: Canadian College of Health Service Executives, 1987.

Davis, Albert J. "Cognitive Style: Methodological and Developmental Considerations." Child Development 42 (1971): 1447-1449.

Davis, Kent J. and Hurbert J. Klausmeir. "Cognitive Style and Concept Identification As A Function Of Complexity and Training Procedures." Journal of Educational Psychology 61 (1970): 423-38.

De Bello Thomas C. Comparison of Eleven Major Learning Styles Models: Variables: Appropriate Populations: Validity of Instrumentation: and the Research Behind Them. New York: Learning Styles Network, 1988.

Delbecq, Andre L., Andrew H. Van de Ven, and David H. Gustafson. Group Techniques for Program Planning. Illinois: Scott Foresman and Co., 1975.

Della-Dora, Delmo, and Lois Jerry Blanchard, eds. Moving Toward Self-Directed Learning. Virginia: ASCD, 1979.

Denson, Teri A. "Three Measures of Cognitive Style: Characteristics, Factor Structure and Implications for Researchers." Paper presented an the Annual Meeting of the American Educational Research Association, April 1977.

Drummond, Robert J. and Walter G. McIntire. "Evaluation Of Instruction." College Student Journal 11 (Fall 1977): 220-23.

Dubin, Samuel S., and Morris Okum. "Implications of Learning Theories For Adult Instruction." Adult Education 24(1973): 3-17.

Dunn, Rita, Thomas DeBello, Patricia Brennan, Jeff Krimsky, and Peggy Murrain. "Learning Style Researchers Define Differences Differently." Educational Leadership 38 (February 1981): 372-375.

Dunn, Rita, Kenneth Dunn, and Gary E. Price. "Learning Styles: Research vs Opinion." Phi Delta Kappan 62 (May 1981): 34-35.

Dunn, Rita. "Teaching in a Purple Fog: What We Don't Know About Learning Style." NASSP Bulletin 65 (March 1981) 33-36.

English, Horace, B. The Historical Roots of Learning Theory. New York: Doubleday & Company, Inc., 1954.

Ferrell, Barbara G. "A Factor Analytic Comparison of Four Learning Instruments." Journal of Educational Psychology 75: 33-39.

Ferrell, Barbara G. "Using the NASSP Learning Style Profile." In Profiling & Utilizing Learning Style, edited by James W. Keefe. Virginia: NASSP, 1988

Gagne, Robert M. Essentials of Learning for Instruction. New York: Holt, Rinehart and Winston, 1975.

Gagne, Robert M. The Conditions of Learning. New York: Holt, Rinehart and Winston, 1970.

Gagne, Robert M., Leslie J. Briggs, and Walter W. Wager, The Principles Of Instructional Design. New York: Holt, Rinehart and Winston, Inc., 1988.

Gardner. Riley W. "Cognitive Styles in Categorizing Behavior." Journal of Personality 22(Sept. 1953): 214-223.

Glass, Gene V., and Kenneth D. Hopkins. Statistical Methods In Education and Psychology. New Jersey: Prentice-Hall, Inc., 1984.

Gordon, Theodore and Olaf Helmer. "Report On A Long-Range Forecasting Study." In Social Technology, edited by Olaf Helmer. New York: Basic Books, Inc., 1966.

Gregorc, Anthony F. "Learning Style/Brain Research: Harbinger of an Emerging Psychology." In Student Learning Styles and Brain Behavior, edited by NASSP. Virginia: NASSP, 1982.

Griggs, Shirley A. and Gary E. Price. "Self-Concept Relates to Learning Style in the Junior High." Phi Delta Kappan 62 (April 1981): 604.

Guilford, J.P. "Cognitive Styles: What Are They?," Educational and Psychological Measurement 40(Autumn 1980): 715-35.

Guyer, B. LaRue and Morton P. Friedman. "Hemispheric Processing and Cognitive Styles in Learning-Disabled and Normal Children." Child Development 46 (Sept. 1975) 658-68.

Hale, Janice. "Black Children: Their Roots, Culture, and Learning Styles." Young Children 36 (Jan. 1981): 37-50.

Hall, Bruce W. "Survey of the Technical Characteristics of Published Educational Achievement Tests." Educational Measurement: Issues and Practice 4 (Spring 1985): 6-14.

Hallahan, Daniel P. "Cognitive Styles-Preschool Implications for the Disadvantaged." Journal of Learning Disabilities 3 (Jan. 1978): 6-11.

Helmer, Olaf. "An Agenda For Futures Research." Futures The Journal of Forecasting and Planning 7 (Feb. 1975): 3-14.

Helmer, Olaf. Social Technology. New York: Basic Books, Inc., 1966.

Hill, Joseph E. How Schools Can Apply Systems Analysis. Indiana: Phi Delta Kappa Educational Foundation, 1972.

Hill, Joseph E. The Educational Sciences-A Conceptual Framework. Michigan: Hill Educational Sciences Research Foundation, 1981.

Hunt, David E. "Learning Style and Student Needs: An Introduction to Conceptual Level." In Student Learning Styles Diagnosing and Prescribing Programs, edited by NASSP. Virginia: NASSP, 1979.

Kaley, S. B. "Field Dependence/Independence And Learning Styles in Sixth Graders." Ph.D diss., Hofstra University, 1977.

Keefe, James W. "Assessment of Learning Style Variables: The NASSP Task Force Model." Theory Into Practice 24 (Spring 1985): 138-144.

Keefe, James W. "Assessing Student Learning Styles: An Overview." In Student Learning Styles and Brain Behavior, edited by NASSP. Virginia: NASSP, 1982.

Keefe, James W. "Learning Style: An Overview." In Student Learning Styles Diagnosing and Prescribing Programs, edited by NASSP. Virginia: NASSP, 1979.

Keefe, James W., ed. Profiling & Utilizing Learning Style. Virginia: NASSP, 1988.

Keefe, James W. and John S Monk. National Association Of Secondary School Principals Learning Style Profile Examiner's Manual. Virginia: NASSP, 1987.

Lawson, Anton E. and Warren T. Wollman. "Cognitive Level, Cognitive Style, and Value Judgment." Science Education 62 (1977): 397-407.

Lawrence, Gordon. "Personality Structure and Learning Style: Uses of the Myer-Briggs Type Indicator." In Student Learning Styles and Brain Behavior, edited by NASSP. Virginia: NASSP, 1982.

Lepke, Helen S. "Assessing Individual Learning Styles: An Analysis of Five Instrument.: Foreign Language Annals 11: 657-68.

Letteri, Charles. "Cognitive Profile: Basic Determinant of Academic Achievement.: The Journal Of Educational Research 73 (March/April 1980): 195-99.

Letteri, Charles A. "The NASSP Learning Style Profile and Cognitive Processing." In Profiling & Utilizing Learning Style, edited by James W. Keefe. Virginia: NASSP, 1988.

Linstone, Harold A., and Murray Turoff, eds. The Delphi Method Techniques and Applications. Massachusetts: Addison-Wesley Publishing Co., 1975.

McNary, Susan, William B. Michael, Leo Richards, and Constance Lovell. "Interrelationships Among Psychological Measures of Cognitive Style and Fantasy Predispositon in a Sample of 100 Children in the Fifth and Sixth Grades." Educational and Psychological Measurement 35 (1975): 477-85.

Meherens, William A. and Irvin J. Lehmann. Measurement and Evaluation in Education and Psychology. New York: Holt, Rinehart and Winston, Inc., 1973.

Michigan Developmental Disabilities Council. Research and Evaluation. "Quality of Family Support Evaluation," Lansing, Michigan: Department Of Mental Health, July 1989.

Moore, Carl M. Group Techniques For Idea Building. California: Sage Publications Inc., 1987.

Mullally, Lee. "Educational Cognitive Style: Implications for Instruction." Theory Into Practice 16 (Oct. 1977): 238-42.

NASSP. Student Learning Styles and Brain Behavior. Virginia: NASSP, 1982.

NASSP. Student Learning Styles Diagnosing and Prescribing Programs. Virginia: NASSP, 1979.

Nutt, Paul C. Planning Methods For Health And Related Organizations. New York: John Wiley & sons, 1984.

Operach, Paul M. "Utilization of Consensus Techniques by Speech Therapists To Increase Alternative Speech and Language Models for Elementary Children." Ed.D. thesis, Nova University, 1988.

Readence, John E. "Cognitive Style An Oral Reading Behavior Of Third Grade Children." Reading Improvement 14 (Fall 1977): 175-81.

Renzulli, Joseph S., and Linda H. Smith. Learning Styles Inventory: a Measure of Student Preference for Instructional Techniques. Connecticut: Creative Learning Press, Inc., 1978.

Rowntree, Derek. Statistics Without Tears. New York: Charles Scribner's & Sons, 1981.

Schlesinger, Herbert J. "Cognitive Attitudes in Relation to Susceptibility to Interference." Journal of Personality 22(Sept. 1953): 354-374.

Sigg, Jan Marie and Richard M. Gorgirilo. "Creativity And Cognitive Style In Learning Disabled And Nondisabled School Age Children." Psychological Reports 46 (1980) 299-305.

Smith, Ellen R. and Timothy C. Standal. "Learning Styles and Study Techniques." Journal of Reading 24 (1981): 598-602.

Stewart. Emily. "Learning Styles Among Gifted/Talented Students: Instructional Preferences." Exceptional Children 48 (Oct. 1981): 134-38.

Sweigert, Ray L., and William H. Schabacker. "The Delphi Technique: How Well Does It Work in Setting Educational Goals." Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, Illinois, April, 1974.

Swinnen, Stephan, Joost Vandenberghe, and Erik Van Assche, "Role of Cognitive Style Constructs Field Dependence-Independence and Reflection-Impulsivity in Skill Acquisition." Journal of Sport Psychology 8 (1986): 51-69.

Thomson, Scott D. "Next Steps." In Student Learning Styles and Brain Behavior, edited by NASSP. Virginia: NASSP, 1982.

Uhl, Norman P. "Consensus and the Delphi Process." Paper presented at the Annual Meeting of the American Educational Research Association, Washington, D.C., April 1975.

Wadsworth, Barry J. Piaget's Theory of Cognitive Development. New York: Longman Inc., 1971.

Weatherman, Richard, and Karen Swenson. "Delphi Technique." In Futurism In Education, edited by Stephen P. Hencley. California: McCutrham Publishing Corp., 1974.

Weaver, Timothy W. "Delphi, A Critical Review. A Research Report." A special report prepared at the request of the Office of Education, U.S. Department of Health, Education, and Welfare. Washington: Feb. 1972.

Weaver, Timothy W. "The Delphi Forecasting Method." Phi Delta Kappan 52 (Jan. 1971): 267-271.

Weiss, Neil, and Matthew Hassett. Introductory Statistics. Massachusetts: Addison-Wesley Publishing Co., 1982.

Welty, Gordon. "Some Problems of Selecting Delphi Experts for Educational Planning and Forecasting Exercises." California Journal of Educational Research 24 (May 1973): 129-134.

Witkin, H.A., C.A. Moore, D.R. Goodenough, and P.W. Cox. "Field-Dependent and Field-Independent Cognitive Styles and Their Educational Implications". Review of Educational Research (Winter 1977)" 1-64.

Witkin, Herman A., Carol A. Moore, Philip D. Oltman, Donald R. Goodenough, Florence Friedman, David Owen, and Evelyn Raskin. "Role of the Field-Dependent and Field-Independent Cognitive Styles in Academic Evaluation: A Longitudinal Study." Journal of Educational Psychology 69 (1977): 197-211.

Willis, D.B., and C.A. Bartell. "Japan's Educational Leaders: A Look at Excellence in Educational Administration." International Schools Journal 15(Spring 1988): 17-31.

Yeats, Pearline P. and Gerald A. Strag. "Flexibility of Cognitive Style and Its Relationship to Academic Achievement in Fourth and Sixth Grades." The Journal Of Educational Research 64 (April 1971): 345-6.

Young, Wanda Ena. "Family Studies Program Development At The College Level: A Delphi Study." Ph.D. diss., Michigan State University, 1977.

Zanden, James W. Vander, and Ann J. Pace. Educational Psychology In Theory And Practice. New York: Random House, 1984.