To the Graduate Council:

I am submitting herewith a dissertation written by Danal Wayne Neal entitled "A Training Needs Assessment Model Developed by the Delphi Process for Technology Transfer Programs." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Technological and Adult Education.

Clifton P. Campbell 21 Apr. 94

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We have read this dissertation and recommend its acceptance:

Accepted for the Council:

Associate Vice Chancellor
and Dean of The Graduate School

A TRAINING NEEDS ASSESSMENT MODEL DEVELOPED BY THE DELPHI PROCESS FOR TECHNOLOGY TRANSFER PROGRAMS

A Dissertation

Presented for the

Doctor of Education

Degree

The University of Tennessee, Knoxville

Danal Wayne Neal

May 1994

Dedication

This work is dedicated to the memory of my mother, Gavis Eleanor Baer-Neal who passed away March 17, 1993 in the midst of this effort. She taught me the value of education and always inspired me to reach the best of my potential.

She received the Ohio Certificate of High School Equivalence (GED) on June 19, 1984 at the age of 58.

She told me that "she wanted to complete her high school degree before her first grandchild graduated from high school." She achieved her goal! And Mom, so did I.

Acknowledgments

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I greatly appreciate the assistance of the Office of Technology Applications of the Federal Highway Administration. Its director Janet Coleman and staff

member Bob Kelly were extremely helpful in coordinating this effort among the 51 technology transfer programs throughout the United States and its territories.

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Abstract

The purpose of this study was to determine the components of a training needs assessment and to combine these components into a training needs assessment model. The model was developed through a Delphi process using a panel of experts. The model was rated with a survey instrument distributed to and received from a population of technology transfer program planners (practitioners). A review of the literature revealed that even though many training needs assessment methods have been identified, little work was done to build a model which would assist technology transfer programs in determining the training needs of program incumbents.

The study was conducted in two parts. In the first part a panel of experts, participating in a Delphi study, identified and classified 18 components into 5 different model phases. The phases identified were Background, Investigation, Implications, Outcome, and Impact. Each of the 18 components was placed in one of these five model phases.

In the second part of the study, the identified components were assembled into a questionnaire and rated by technology transfer practitioners from 51 technology transfer programs sponsored by the Federal Highway Administration.

The major findings from this study included a critical review of the Delphi model-building process. This review was followed by an analysis of the data from the rating phase of the study. The major findings included the following.

1. The Delphi process was invaluable in initiating and categorizing the components of the Training Needs Assessment for Technology Transfer Model.

2. Using the Delphi process for model-building requires administration and direction from the researcher.

3. The Delphi process is time-consuming for members of the panel of experts. The researcher needs to continue encouragement and "cheerleading" to receive results.

4. When using the Delphi process to build models, the number of rounds can become overly extensive due to the need to summarize and present the expert responses.

5. The final approval of the research required consensus. Consensus, even when the experts are not dealing face to face, is a demanding process of ensuring that each of the experts is content with the model.

6. A model built using a panel of experts and the Delphi process can potentially alienate practitioners. Practitioners may resent using a model designed by others. This situation is inherent to the implementation of any process and is generally dealt with by requiring more participation from the practitioners.

The findings in Part II of the study indicated the reactions of the practitioners to the components identified by the experts.

1. The components rated lowest in importance by the practitioners were: determine the setting for training needs assessment, identify performance differences, and initiate environmental scanning.

2. The components rated lowest in amount of use by the practitioners were: determine the setting for training needs assessment, evaluate existing performance levels, determine optimal performance, identify performance differences, and initiate environmental scanning.

3. The components rated lowest in appropriateness by the practitioners were: determine the setting for training needs assessment, determine optimal performance, identify performance differences, and initiate environmental scanning.

4. The components rated lowest by the practitioners for willingness to use the component in a technology transfer program were: identify performance differences and initiate environmental scanning.

5. Ten of the practitioners sent letters expressing their feelings along with their complete or incomplete questionnaires. The dissatisfaction of some of the practitioners concerning the model is noted in the appendix of the dissertation.

The results of the rating part of the study indicated that the panel of experts in the Delphi phase of the study identified, classified, and categorized effective components for a training needs assessment for use by technology transfer programs.

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Chapter I

Problem to be Studied

Background of the Problem

Technology Transfer Programs

Technology transfer programs are vital to the continuing and adult education programs developed for the transportation industry. Under the Local Transportation Assistance Program (LTAP), the Federal Highway Administration (FHWA) established a technology transfer program in each state to provide training and technical assistance for local and county transportation personnel.

The goal of the program is to train local personnel in the best methods of inspection, maintenance, and repair of roadways to avoid more costly future repair or replacement needs (FHWA, n.d.). For example, if local transportation personnel are trained in bridge inspection procedures and are able to detect and correct problems early, a more costly bridge replacement may be avoided. A major component ensuring the success of these technology transfer programs is the training needs assessment method that is established.

Training Needs Assessment Methods

A review of the literature covering the topic of training needs assessment revealed that the term "training

needs assessment" has no firm conceptual definition or foundation. Many methods are used to assess needs. Pennington (1980a) identified the six methods most commonly used in the conduct of training needs assessments. These are outlined below:

1. Analytic method. This method is prescriptive in nature and is more likely to be effective if the practitioner is a skilled problem solver. In this method, an outsider assesses the need by analyzing outside information.

2. Democratic method. This process uses parliamentary procedure to guide a group process through the use of a Delphi technique. The purpose of this method is to reach a consensus by experts, identifying needs through the process of mutual professional opinion.

3. Diagnostic method. This particular method approaches training needs assessment from the perspective that denial of the need would prove to be harmful. The method reflects both performance-based and non-performance-based inefficiencies produced by the denial of the need.

4. Individual appraisal method. In this instance, individuals assess their own training needs, either as a group or as individuals. This method relies on the individual or group to initiate the assessment and to follow-up on the process.

5. Individual self-fulfillment method. The individual self-fulfillment method relies on a random appeal to identify training "needs." These needs are perceived as wants or desires. Pennington (1980b) wrote that these training needs are reflected as individual, rather than community, needs.

6. System discrepancy method. This training needs assessment method uses inquiry to identify the way things are and the way they should be. This approach then attempts to (a) define the deficiencies between the existing process and the ideal process, and (b) develop an intervention scheme for supplying a remedy.

Appendix A, prepared by the researcher, summarizes these methods and provides an example of how each could be used by one of the technology transfer programs sponsored by the FHWA.

If one of these training needs assessment methods is to be used, which is the most likely to succeed? Each has its limitations, particularly involving the perceptions of need by the individual or group making the assessment.

Statement of the Problem

There is little guidance for technology transfer programs to follow in assessing their training needs. Models for curriculum development, such as the Instructional Systems Development (ISD) model (Campbell, 1986), often

begin with the assumption that a needs assessment has identified an educational or training need. There is no model with a needs assessment phase for technology transfer programs to follow.

Purpose of the Study

The purpose of the study was to determine the components of a training needs assessment and to combine those components into a training needs assessment model. The model was developed through a Delphi process using a panel of experts. The model was rated with a survey instrument distributed to and received from the population of technology transfer program planners (practitioners).

To fulfill the purpose of this study, the following research questions are to be answered.

1. What does a panel of experts determine to be the major components of a training needs assessment process for technology transfer?

2. Based on the model developed by the experts, how are components of the model derived by the panel of experts perceived by technology transfer program planners (practitioners), in each of the following dimensions: (a) the importance of each training needs assessment component to their operations, (b) the amount of use of each component in the planning procedures of the technology transfer program, (c) the appropriateness of each component and its

usefulness to the technology transfer program, and (d) the technology transfer programs' willingness to use each component?

Need for the Study

This study was needed to identify components for a training needs assessment model and to determine their importance to the training needs assessment process.

The primary responsibility of technology transfer programs sponsored by the FHWA is to provide training and technical assistance for local and county transportation personnel. These technical training programs are required to show measurable effectiveness. It is not apparent whether the individuals performing the technical training planning process for the technology transfer programs are well-versed in the implementation of an effective training needs assessment.

The need for the development of effective components for a training needs assessment model was emphasized by Sork and Caffarella (1990) who addressed the need to correct shortcomings in the training needs assessment literature:

> Building a theory that takes into account the exigencies of day-to-day responsibilities of practitioners will require a collaboration between scholars and practitioners that is much closer than is usually found in adult education. . . . Scholars,

> working with practitioners, can then go to work refining theory so that it takes into consideration the contextual factors that affect planning. (p. 243)

Sork and Caffarella (1990) proposed the most logical rationale for the necessity of planning in general, and more specifically, the importance of a training needs assessment in adult and continuing education programs. The specifics of the literature identified areas "in which there remain substantial gaps between what theorists say should be done and what practitioners do" (p. 234). Sork and Caffarella indicated that training needs assessment theory could become more relevant to practitioners only if there is a reduction in the discrepancies between what practitioners do and what scholars theorize should be done.

This study has implications for initial and continuing education and training. Training needs assessment is a task performed by technology transfer programs.

Limitations and Delimitations

There were three limitations of the study. First, the Delphi panel of experts was small, consisting of only five members. Second, there was considerable potential for technology transfer program practitioners in different states to confer with or influence one another because of the frequent contacts between programs. The researcher attempted to control this by asking respondents not to

confer with each other about the research. Third, the findings cannot be generalized beyond the transportation industry.

Assumptions

One assumption of the study was that the participants, technology transfer program directors and/or planners, want to assess their training needs so that they can improve their training program offerings. However, as discussed earlier, there are discrepancies between what practitioners do and what scholars theorize should be done. Additional assumptions were that the most effective components of the training needs assessment model were identified and that the training needs assessment model that was developed will work.

Definitions of Terms Relevant to This Study

1. Delphi process. As defined by Dalkey and Helmer (1963), Delphi is a process "which was devised in order to obtain the most reliable opinion consensus of a group of experts by subjecting them to a series of questionnaires in depth interspersed with controlled opinion feedback" (p. 458).

2. Needs assessment. Needs assessment is the task of quantifying and measuring the performance of clientele. The organization's actual level of performance is compared to a

desired level of performance. Performance is identified through job and task analyses. The result is a specific proposal to solve a deficiency-based problem.

3. Technology transfer. As defined by the U.S. Department of Energy (DOE) (1991):

> Technology transfer is the process by which technology, knowledge, and/or information developed in one organization, in one area, or for one purpose is applied or utilized in another organization, in another area, or for another purpose. (p. 1-1)

4. Technology transfer program. At the time of the study, 51 technology transfer programs had been established by the FHWA in the United States and its territories under the LTAP program. Technology transfer programs provide technical assistance and training to rural and small city transportation agencies. Training is provided on topics related to building, maintaining, and repairing roads; maintaining bridges; and providing rural public transportation.

Chapter II

Literature Review

Introduction

The literature review for this study was organized under the topic headings of (a) training needs assessment, (b) the Delphi process, and (c) technology transfer. The technological education planning methods reviewed were those dealing with planning programs from the theoretical base of performance-based instruction, such as the ISD approach researched by Campbell (1986). The concepts of economics and politics as they relate to planning in technical areas were addressed from research by Copa and Moss (1983).

The purpose of the study was to determine the components of a training needs assessment and to combine those components into a training needs assessment model. The model was developed through a Delphi process using a panel of experts. The model was rated with a survey instrument distributed to and received from the population of technology transfer program planners (practitioners).

Research completed by scholars in this field was reviewed extensively. The training needs assessment model of Boone, Dolan, and Shearon (1971) was studied because of its specific orientation to programming in the cooperative extension service.

Studies concerning continuing and adult education program success and failure were reviewed. Work done by Lewis and Dunlop (1991) on perceptions, explanations, and implications of successful and unsuccessful continuing and adult education programs served as the basis for this research. All three of the topics, which were relevant to this study, were applied to the research and incorporated into the references. (Appendix B is a list of all sources reviewed in the subject areas of training needs assessment, the Delphi process, and technology transfer.)

Training Needs Assessment

A review of the literature covering the topic of training needs assessment produced two observations. First, the term "training needs assessment" had no widely accepted conceptual definition or foundation for implementation. Second, the terminology relating to the implementation of a training needs assessment was confused by the perspective in which the process was implemented. The term "training needs assessment" was used interchangeably with the process of measuring the "need" for training by comparing a measured level of performance to a desired level of performance. Additionally, the term applied to the "need" for training as evidenced by the perceptions of the target population.

The process of investigating the concept of training needs assessment was important for most training and

development interventions. A thorough understanding of the term was necessary prior to using this technique in research or course development and delivery.

Training Needs Assessment, A Working Definition

There was little if any agreement on what the term "training needs assessment" means or how it was applied. In reviewing the literature related to the process of program planning, the concept of training needs assessment was referred to in each program planning method. Sork and Caffarella (1990) wrote that Witken performed one of the most comprehensive reviews of the literature reported and found that:

> In the context of needs assessment . . . the term need is properly used only as a noun with the denotation of a discrepancy or gap between some desired or acceptable condition or state of affairs and the actual or observed or perceived condition or state of affairs. (p. 236)

Sork and Caffarella (1990) proposed an excellent summary to this continuing dilemma and placed the further pursuit of this definition of training needs assessment in proper perspective. Their summation was so succinct that it needed to be presented in its entirety to set the stage for the further exploration of the process of defining the term "training needs assessment."

> Although the centrality of needs assessment in the planning literature is undisputed, there is a growing number of scholars and practitioners who urge a revision in thinking about the importance of needs assessment to effective educational planning. Practitioners argue that they rarely have time to conduct needs assessments. More often than not they justify offering programs based on potential demand (which may or may not have anything to do with need) or based on the availability of the resources required to offer the programs (such as an instructor or a classroom filled with microcomputers). There appears to be a serious gap between the process as described in the literature and the actual practice of needs assessment. (p. 237)

Sork and Caffarella introduced the problems facing the use of the training needs assessment; however, there was still no concrete definition of the term "training needs assessment" for use in the training assessment process.

A further focus on the term "training needs assessment" was to present the term in the context in which it had been used and implemented. Pennington (1980b) identified three purposes for the use of the training needs assessment: "analyzing clientele, identifying topics, and specifying areas of need" (p. 3). This diagnosis of the purpose of

assessing needs indicated that the training needs assessment process was more dynamic than merely market research.

Another purpose of the training needs assessment was to specify areas of need. This process identified the difference between the way things were and the way they were proposed to be. In this instance, the training needs assessment was prescriptive in nature and was used to identify problems and portray the magnitude of their impact.

A definition of training needs assessment was still elusive. Bjorkquist and Murphy (1987), in a paper presented to assist teachers in conducting a training needs assessment in industry, made an early attempt at defining the term in understandable terminology. According to their definition, "needs assessment is an investigation process that results in a proposal to solve a problem" (p. 32). Bjorkquist and Murphy used a performance-based criterion for their analysis of training needs assessment.

Preskill (1991) went beyond Bjorkquist and Murphy (1987) in defining training needs assessment. Preskill began getting to the essence of the term. The establishment of his definition was a thesis on training needs assessment. "To ensure the greatest productivity of human resource professionals, it is critical that they be provided with knowledge, skills, and attitudes based on their specific needs" (p. 144). This quotation clarified the definition of the training needs assessment process. Preskill built a

resolute defense for the foundation of the training needs assessment process.

A definition of training needs assessment continued to evolve from the input of Bjorkquist and Murphy (1987) and Preskill (1991). A conceptual combination of these definitions was used to develop a derivative definition.

Brackhaus (1984) attempted to synthesize the concept of needs analysis and training needs assessment in his definition of training needs assessment. This synthesis brought a usable definition of training needs assessment into focus. Brackhaus wrote:

> The needs assessment process is composed of identification and analysis of needs; it requires appropriate diagnostic procedures. During needs analysis, the identified needs are evaluated according to established criteria. This process is analogous to screening needs through various filters. . . .
>
> Priorities are then set based on needs. (p. 233)

Conceptually, the Brackhaus definition of training needs assessment helped clarify the term "training needs assessment." The only flaw in the definition was a structured clarification of what was meant by "need."

Beatty (1981), in addressing the concept of training needs assessment, produced a substantive description of what a training needs assessment is and what it is not. Beatty put this into perspective when she wrote:

> If we are to proceed together in any discussion of the needs assessment process, it is imperative that we share a common perception of how the term is being used. As we define the term, and as many planners are currently defining the term, need is not a problem, not a present degraded situation; need is not an end, not a future goal to be achieved; need is not a means, not a planned program to attain an end. Need is a discrepancy between where people are and where they want to be or where someone else thinks they are and they ought to be. Need is the gap between a present condition and a desired future condition. (p. 15)

The literature referring to the definition of training needs assessment repeatedly referred to performance-based criteria. Due to this common observation, an attempt was made to derive a usable definition from the many that were proposed by published authors in the field.

Training Needs Assessment, A Derivative Definition

Training needs assessment was the task of quantifying and measuring the performance of clientele as the performance related to the organization's actual level of performance compared to a desired level of performance. Performance was identified through job and task analysis and resulted in a specific proposal to solve a deficiency-based problem.

This process of determining the derivative definition of the term "training needs assessment" set the stage for a clearer comprehension of the difference between a preconceived concept of the application of assessing needs and a perception of the process of measuring performance. Without this cognizance of the quantifying measures for determining the need for training as measured by where things are compared to where they should be, the process of training needs assessment was not addressed. This task-analysis-based method dispelled the previously held belief that training needs assessment was nothing more than the compilation of the results of a questionnaire sent to clients asking them what it was they wished to learn.

Training needs assessment was not the process of assessing perceived needs and then introducing training as an intervention because someone felt that it was necessary. This derivative definition was similar to one compiled by Rossett (1987), who wrote that training needs assessment "is the systematic study of a problem or innovation, incorporating data and opinions from varied sources, in order to make effective decisions or recommendations about what should happen next" (p. 3).

Delphi Process

The Delphi process originated at Rand Corporation in the early 1960s. The works of Dalkey (1969), Gordon (Gordon

and Helmer, 1966), Helmer (1967), and Kaplan (Kaplan, Skogstad, and Girshick, 1950) were studied for this section of the literature review.

Norman Dalkey and Olaf Helmer created the Delphi process by using the methods outlined in a 1962 Rand Corporation study entitled An Experimental Application of the Delphi Method to the Use of Experts (Dalkey & Helmer, 1963). This U.S. Air Force project became an experiment which "was designed to apply expert opinion to the selection, from the viewpoint of a Soviet strategic planner, of an optimal U.S. industrial target system and to the estimation of the number of A-bombs [atomic bombs] required to reduce the munitions output by a prescribed amount" (p. 458).

Dalkey and Helmer developed and employed a technique designed to repeatedly question experts by the use of interviews or questionnaires. This process specifically avoided direct interaction between the members of the panel of experts. Dalkey and Helmer used this process and prescribed the method by which the process should be implemented. The sequence of the procedures in the process is described below.

Dalkey and Helmer Delphi Procedures

Delphi procedures commenced with "questions, which are all centered around some central problem" (Dalkey & Helmer,

1963, p. 485). These questions "are designed to bring out the respondent's reasoning that went into his reply to the primary question" (p. 458). This step in the Delphi process was the beginning, and the "primary question" of the research was proposed in the first phase of the study.

The purpose of the Delphi process was to reach consensus on the solution or definition of the "primary question." Dalkey and Helmer wrote that this "controlled interaction among the respondents represents a deliberate attempt to avoid the disadvantages associated with more conventional uses of experts, such as round-table discussions or other milder forms of confrontation with opposing views" (p. 459).

The panel of experts was designated and finalized in the early part of the process. Dalkey and Helmer used seven experts from diverse disciplines related to the "primary question."

Dalkey and Helmer administered five questionnaires, submitted at approximately weekly intervals. In this step of the process the structure of Dalkey and Helmer's procedures became individually suited to the problem proposed by the "primary question."

Dalkey and Helmer initiated the Delphi process on an experimental basis. Their colleague at Rand, Harold Sackman, developed the most comprehensive explanation of the process (Sackman, 1975).

> Delphi is an attempt to elicit expert opinion in a systematic manner for useful results. It usually involves iterative questionnaires administered to individual experts in a manner protecting the anonymity of their responses. Feedback of results accompanies each iteration of the questionnaire, which continues until convergence of opinion, or a point of diminishing returns, is reached. The end product is the consensus of experts, including their commentary, on each of the questionnaire items, usually organized as a written report by the Delphi investigator. (p. xi)

This study incorporated the four steps inherent to Delphi studies. These steps were: (a) defining the scope of the inquiry, (b) establishing professional standards for questionnaires, (c) evaluating the process with respect to "its assumptions, principles, and methodology" (Sackman, 1975, p. xii), and (d) drawing conclusions and making recommendations.

The use of the Delphi process in both its original and other "modified" forms accelerated over the last 30 years. In addition to Sackman's critique, the Delphi process attracted numerous criticisms as to its potential as a research tool. Harold Linstone (1975) criticized the use of the Delphi process in a positive manner. Linstone delineated eight basic pitfalls that assisted researchers in designing and implementing Delphi studies. These pitfalls,

along with brief summaries of their implications for the Delphi process, appear in the following list.

Linstone's Eight Basic Pitfalls

1. Discounting the future. This pitfall stipulated that planners and society in general had a "very short planning horizon as well as a short memory" (Linstone, 1975, p. 574). As written by Linstone, experts evaluated the future differently based on cultural and social status. Delphi required a long-term outlook. Because of cultural and social pressures on the Delphi experts, their long-term outlook was limited. The use of Delphi experts in discounting the future was best summarized by Linstone as follows: "A slum dweller worries about rats he can see, the jet set worries about depletion of wild game in distant Africa" (p. 575).

2. The prediction urge. The Delphi process was criticized because researchers and the public tended to use the results of studies as predictions for the future. "The oracle at Delphi, Nostradamus, Jeanne Dixon, and Edgar Cayce have all been popular because, in effect, they dispelled uncertainty about the future" (p. 578). Linstone stipulated that Delphi was used as two-way communication between experts and researchers rather than a device to make predictions (p. 578).

3. The simplification urge. The use of Delphi in research tended to lead both the researcher and the interpreter to oversimplify the process that achieved the Delphi results. Delphi studied the interaction of experts and reconstituted these interactions into dynamic interpretations. The results of Delphi were too complex to oversimplify and adopt experts' interpretations as the truth.

4. Illusory expertise. "In the application of Delphi to forecasting, reliance was almost invariably placed on panels of experts or specialists. As those familiar with forecasting have learned, the specialist is not necessarily the best forecaster" (p. 581). The use of experts introduced these experts' biases into the study.

5. Sloppy execution (execution errors). Linstone cited three major execution errors in the use of Delphi. The first error was sloppy execution in the selection of the panel of experts. Selection of the panel of experts "can produce a cozy group of like-thinking individuals which excludes mavericks and becomes a vehicle for inbreeding" (p. 583). The second error was sloppy design of the "primary question." Both Linstone and Turoff (1975) and Dalkey and Helmer (1963) agreed that this was a critical element to the success of a Delphi study. The third error, "sloppy execution," occurred when procedures were bypassed in an effort to get the project over with.

6. Optimism-pessimism bias. Experts and interpreters of Delphi studies brought not only their biases into the process, but also their outlooks of optimism and pessimism. If the Delphi consensus was agreeable to their outlook, a consensus was reached. Experts adjusted their observations and input, and interpreters of the study adjusted their understanding of studies, depending on how they viewed the information from their optimism-pessimism bias.

7. Overselling. "In their enthusiasm some analysts have urged Delphi for practically every use except cure of the common cold" (p. 584). Delphi was not the best research tool for every situation. Linstone (1975) wrote that "an unfamiliar and anonymous communication system can develop into a threat to established individuals and intraorganizational relationships. Like other analytical tools, it can serve in an advocacy role as well as in an inquiry role" (p. 585).

8. Deception. The final pitfall cited by Linstone dealt with the role of deception in the process. What would happen if the experts lied, either deliberately or out of ignorance? The misinformation would remain in the study and the study would be flawed.

Technology Transfer

The concept of technology transfer was a "new spin" on an old procedure. An accepted definition for technology

transfer came from the DOE (1991) and was expressed as follows:

> Technology transfer is the process by which technology, knowledge, and/or information developed in one organization, in one area, or for one purpose is applied or utilized in another organization, in another area, or for another purpose. (p. 1-1)

Delphi panel of experts member Dr. Thomas J. Sork included the following parallel comment on one of the questionnaires in this study:

> The notion of technology transfer has been around for many years. In the initial questionnaire and introduction, you make it sound as if the idea represents an innovation or something that hasn't been thought of before. It might be useful to acknowledge that the idea of technology transfer and concern about education/training to promote technology transfer has been around for decades. The best place to look for literature on this is in agricultural extension.

Dr. Sork hit upon an important point and it should be stressed that technology transfer was new terminology for what agricultural extension had been doing for some time. Regardless of the similarities, the term technology transfer was ubiquitous in the training literature. A review of recent literature on the subject revealed no substantive

research concerning training needs assessment in relation to technology transfer.

Much of what was written and published on technology transfer dealt with the legislative initiatives for the concept and the procedural elements for initiating technology transfer. DOE's orientation handbook entitled Technology Transfer, A DOE and Industry Partnership: An Orientation Handbook categorized most technology as scientific knowledge transfer, program-direct technology transfer, or spin-off technology transfer (DOE, 1991, p. 1-2).

Legislation dealing with technology transfer encompassed a period beginning with the Atomic Energy Act of 1954 (Public Law 83-703). The most recent legislation dealing with technology transfer culminated with the passage of the National Competitive Technology Transfer Act of 1989 to accommodate the major impetus for government-sponsored technology transfer activities. In the orientation handbook for DOE (1991), the following statement summarized the legislative aims and procedural goals for technology transfer:

> Concern about the U.S. trade deficit and U.S. competitiveness in world markets has grown in recent years. Legislation has been enacted to strengthen the link between the nation's research and technology base and U.S. industry. As a result of that legislation,

> industry's access to federally developed technologies has improved, and the rights of the laboratories to their own research and development have been protected. (p. A-1)

The FHWA (1992) set the stage for the U.S. Department of Transportation's involvement in the introduction of technology transfer:

> Every aspect of our daily lives is touched by the rapid progress of technology. This fact is most evident in high-technology industries, where ideas translate into new products in an average of 18 months. The transportation community is also pressured to more rapidly evaluate advanced transportation technologies to help the U.S. competitiveness in the world marketplace. (p. 3)

In addition to the National Competitive Technology Transfer Act of 1989, the U.S. Department of Transportation's role in technology transfer was enhanced by the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. This legislation expanded the potential for technology transfer in the transportation industry. The ISTEA provided authorization for highways, highway safety, and mass transportation for the years from 1992 through 1997. Another purpose of ISTEA was to provide a foundation for the nation to compete in the global economy.

The ISTEA emphasized the use of "active partnerships with the transportation industry and academia, coupled with Federal, State, and local governments" (FHWA, 1992, p. 3). The purpose of these partnerships was to "help to expand awareness of new technologies and ensure their development and use" (p. 3). This use of partnerships defined technology transfer and its implementation for the FHWA. Using this concept, the FHWA developed a strategic program for technology transfer that facilitated timely and effective movement of innovative technology.

The Office of Technology Applications was established within the FHWA "to meet the need for this responsiveness and to promote more timely and widespread technology transfer and sharing" (FHWA, 1992, p. 4). These technology transfer activities were coordinated by the FHWA to identify and assess innovative technology, to track development, to assist with marketing and promotion, and to facilitate implementation. These activities were implemented on the local level by the LTAP.

Although the concept of technology transfer had been around for some time, the use of the term and its meaning were relatively new to the research elements of university-government relationships. According to Dr. Gary W. Matkin Associate Dean of University Extension at the University of California at Berkeley (1990), referred to technology transfer as, "transfer of existing technology across

national boundaries (for example, between the United States and the Soviet Union)" (p. 5). Matkin placed the mid-1970's as the time technology transfer became more of an accepted part of the university-government scene. According to Matkin the concept of technology transfer "began to improve for several reasons" (p. 20). Matkin (1990) listed these reasons as follows:

> First, some of the basic research that universities had been doing began to pay off commercially, first in electronics and then biotechnology. Second, general concern about the competitive position of the United States in the world economy increased. Third, the federal commitment to continued funding of university research began to erode as cuts in the federal budget and an economic downturn decreased the amount of government funds spent on research. (pp. 20-21)

Matkin cited the 1980's as the time of technology transfer. "The pace of change related to technology transfer in universities accelerated dramatically after 1979" (p. 22).

To bring the initial reference of technology transfer being an outgrowth of agricultural extension to full circle, the topic was broached again by Matkin when he wrote that there was a major difference between what he termed

agricultural extension and manufacturing extension. The following quotation appeared in the November 17, 1993, issue of The Chronicle of Higher Education.

> Offering industrial-extension services is an appropriate way for the university to serve the society that supports it and to adapt to the increased pressures for universities to become more active in economic development. Such services need not seriously threaten university values, but they undoubtedly will carry academe into new areas that, if not handled carefully, could lead to serious problems and loss of public confidence. Considering the stakes, the analogy being drawn between agricultural extension and manufacturing extension is not only false, it is dangerous.

Technology transfer will obviously be an important topic for both the government and university environment for years to come. It is too early to tell how well technology transfer programs will fulfill their goals. The topic is still in the interpretation and initiation phase. Following the results of these beginnings, there may be additional research and publication concerning technology transfer's impact on academe, manufacturing, and the economy in general.

Chapter III

Procedures

Introduction

The purpose of the study was to determine the components of a training needs assessment and to combine those components into a training needs assessment model. The model was developed through a Delphi process using a panel of experts. The model was rated with a survey instrument distributed to and received from the population of technology transfer program planners (practitioners).

This research study was divided into two parts. Part I of the study enlisted a panel of experts using a Delphi process to determine the components for a training needs assessment methodology for use by technology transfer programs.

In Part II of the study, technology transfer practitioners were requested to react to the model developed by the panel of experts.

Identification of Populations

Delphi Panel of Experts

The population participating in Part I of the study, the Delphi process, was implemented by the researcher according to recommendations by Dalkey and Helmer (1963).

The use of experts is recommended to elicit "a carefully contrived opinion consensus" when "direct empirical evidence" is unavailable (p. 467).

A method for selecting the Delphi panel was not provided by Dalkey and Helmer (1963). Dalkey and Helmer used researcher discretion in establishing a panel of seven experts for their study. The panel of experts consisted of four economists, a physical-vulnerability specialist, a systems analyst, and an electronics engineer. These were chosen by Dalkey and Helmer based on their own information concerning the study.

A recent study by Kenneth S. Volk (1993) used the following criteria for selecting a Delphi panel:

> Three groups of experts participated as members of the Delphi panel: technology educators, educators from international development organizations, and educators representing developing countries. . . . Experts identified were to have demonstrated knowledge in this area through their scholarship, publications, or direct experience in developing countries. (p. 74)

A panel of experts was selected by the researcher to participate in the study. The members of the panel of experts were solicited from: (a) informed individuals in the Department of Technological and Adult Education at The University of Tennessee, and (b) each successive expert identified. The panel of experts chosen consisted of Wright

B. Aldridge, Jr., Dr. Edgar J. Boone, Dr. Walter A. Cameron, Ms. Lisa H. Pogue, and Dr. Thomas J. Sork.

The criteria for selecting the panel of experts were: (a) expertise in the area of training needs assessment, (b) evidence of publications such as refereed articles and other documents on topics involving training needs assessment methodologies, (c) practical experience conducting training needs assessments, (d) an understanding of the need for technology transfer, and (e) a willingness to participate in the study. The criteria for being selected to the panel of experts were developed by the researcher in conjunction with the major professor supervising this study.

The qualifications of each member of the panel of experts are detailed in biographical sketches provided in Appendix C. Their qualifications germane to this study are as follows.

Wright B. Aldridge, Jr., has worked extensively with planning processes for the Tennessee Department of Transportation. He works with universities and technology transfer programs in the United States for the FHWA. His involvement with these groups is as technical adviser and practitioner for training needs assessment. Mr. Aldridge conducts training needs assessments for both the FHWA and statewide technology transfer programs. Mr. Aldridge has presented papers related to the planning and needs

assessment processes for technology transfer programs at the annual meeting of the Transportation Research Board. Mr. Aldridge agreed to serve on the panel of experts.

Dr. Edgar J. Boone is well published in the area of community-based programming in adult education. His work as a county extension agent lends practical expertise to the process of training needs assessment. Dr. Boone has published seven books related to community-based programming. Each of these books includes extensive coverage of the training needs assessment process. Dr. Boone agreed to serve on the panel of experts.

Dr. Walter A. Cameron has expertise in the area of training needs assessment, as evidenced in his publications and consultations. Dr. Cameron has conducted training needs assessments for both private businesses and public agencies. Dr. Cameron's qualifications are further enhanced by his teaching of graduate level courses in research, needs assessment, and workforce planning. Dr. Cameron agreed to serve on the panel of experts.

Ms. Lisa H. Pogue works with all of the FHWA-sponsored technology transfer programs in the United States and its territories. Her involvement includes training in the practice of training needs assessment at both individual and consortium levels. She has presented papers for international meetings, professional associations, and the Transportation Research Board concerning the conduct of

training needs assessment for technology transfer programs. She has advised and assisted in the training needs assessment process. Ms. Pogue agreed to serve on the panel of experts.

Dr. Thomas J. Sork has both a practical and academic background in the subject of planning, resource allocation, and training needs assessment in the area of adult education. His publications concerning the value of training needs assessment in adult education are numerous. Dr. Sork has conducted and assisted graduate students in the conduct of training needs assessments. Dr. Sork agreed to serve on the panel of experts.

Practitioners

The population participating in Part II of this study consisted of educational planners working for technology transfer programs sponsored by the FHWA in locations throughout the United States and its territories. Because of the small population, all 51 centers were surveyed.

Research Design

The five members of the panel of experts were requested to identify the components of a training needs assessment model for technology transfer programs. A Delphi process, described in the literature review in Chapter II, was used with the panel of five experts. The procedures developed by

Dalkey and Helmer (1963) and Sackman (1975) included: (a) proposal of the primary question, (b) designation and finalization of the panel of experts, (c) controlled interaction among the respondents, (d) administration of questionnaires related to the primary question, and (e) drawing conclusions and making recommendations. These procedures were followed to avoid Linstone's eight basic pitfalls discussed in the literature review in Chapter II. These pitfalls included: (a) discounting the future, (b) the prediction urge, (c) the simplification urge, (d) illusory expertise, (e) sloppy execution, (f) optimism-pessimism bias, (g) overselling, and (h) deception.

Research Study Part I, Delphi Study

1. Part I of the research was initiated with a letter sent to candidates for the panel of experts chosen by the criteria listed under the subheading Identification of Populations. This letter requested the involvement of the individuals selected by the criteria discussed under the subheading Identification of Populations and was followed by a personal phone call requesting confirmation of their willingness to participate. Each of the candidates agreed to serve on the panel.

2. A letter was sent to the panel members, explaining the Delphi process to be used and requesting their completion of Delphi Round 1. The open-ended questionnaire

requesting panel members to list the effective components of a training needs assessment. The letter was followed by a FAX requesting their responses in a timely fashion.

3. The panel members suggested components necessary for a training needs assessment. The researcher looked for similarities in and differences between the components suggested by the panel members and grouped the suggested components with similar themes. Themes were identified by the researcher. The researcher wrote a subheading for each theme. This thematic subheading became the component subheading when the suggested components were assembled into a preliminary matrix.

4. The preliminary matrix was modified by the researcher to include only the major headings, the component subheadings developed by the researcher in Step 3, and the components suggested by the panel members. The component author names were excluded in the modified matrix to prevent bias on behalf of the panel member authors in evaluating the developing model.

5. A letter and the modified matrix were sent to the panel of experts. Panel members were asked to review the matrix and to make any changes in the assignment of major headings and subheadings or in the wording of the components. The Round 2 mailing also included an approval form for the panel members to sign and to make general comments.

6. The panel member comments on and revisions to the Round 2 modified matrix were reviewed by the researcher. A diagram was designed to include the major components identified by the panel of experts. Special care was taken to ensure that each panel member's input was included in the diagram process.

7. A cover letter was sent along with the diagram of the preliminary model to the panel of experts. A form was included with the letter and diagram asking each panel member to comment on or approve the preliminary model. The Delphi study followed the Dalkey and Helmer (1963) procedure. This procedure is discussed in the literature review in Chapter II. Holding to the procedures and guidelines in the Delphi process was very helpful in bringing this consensus process to fruition.

Research Study Part II, Rating of Components by Practitioners

Once the final model was approved by the panel of experts, Part II of the research process began.

1. A letter was sent to 51 technology transfer programs established by the FHWA to provide technical assistance and training to rural and small city transportation agencies. This letter included a form to be returned to the researcher designating an individual from each program to be responsible for the study.

2. A survey instrument was developed for the practitioners using the five phases and 18 components of the approved model. Each component was rated in four dimensions--importance, amount of use, appropriateness, and willingness to use. The survey instrument was developed by the researcher with the assistance of the doctoral committee members supervising this study. (See Step 3 for further information.)

3. The survey instrument was structured in accordance with Babbie (1986, pp. 127-135). The questionnaire structure as outlined by Babbie is as follows:

- Questionnaires provide a method of collecting data by (a) asking people questions, or (b) asking them to agree or disagree with statements representing different points of view.
- Questions may be open-ended (respondents supply their own answers) or closed-ended (they select from a list of answers provided them).
- Usually, short items in a questionnaire are better than long ones.
- Negative items and terms should be avoided in a questionnaire because they may confuse respondents.
- Bias is the quality in questionnaire items that encourages respondents to answer in a particular way or to support a particular point of view. Avoid it.

- Operationalization begins in study designs and continues throughout the research project, including the analysis of data. (p. 134)

Members of the committee supervising this study approved the survey instrument for implementation.

4. The practitioner survey instrument was administered to two groups of selected individuals not connected to the study before it was distributed to the practitioner population. The first group was comprised of staff members of the Transportation Center at The University of Tennessee. The staff members chosen to review the draft survey instrument did not work with any FHWA-sponsored technology transfer program and would not be responding to the final practitioner survey instrument. The researcher interviewed each participant after that participant had completed the survey instrument to solicit notes for needed corrections, suggestions for revisions, and other comments on and concerns about the survey instrument. The staff members made minor changes in wording (generally to make terminology consistent), corrected typographical and spelling errors, and noted minor problems in numbering. The staff members made similar minor changes in the cover letter that was to be mailed with the survey instrument.

Two weeks later, the revised survey instrument(with cover letter)was administered to a second group of participants comprised of staff members of the Institute of

Technology Management at The University of Tennessee. These participants were able to use the instrument without problems and provided no comments or suggestions for further revision of the cover letter or survey instrument.

5. The researcher presented the final survey instrument for review to members of the doctoral committee supervising this study. Members of the committee supervising this study approved the survey instrument for implementation.

6. A cover letter along with the survey instrument was sent to the 51 FHWA-sponsored technology transfer programs. The survey instrument listed the training needs assessment components identified by the panel of experts. Each training needs assessment component was accompanied by a closed-end (Likert) scale from 1 to 7.

The (Likert) scale reflected the following values attributed to each of the correlated numerical ratings: (a) 1 = lowest importance, amount of use, appropriateness, and willingness to use; (b) 2 = low importance, amount of use, appropriateness, and willingness to use; (c) 3 = low-moderate importance, amount of use, appropriateness, and willingness to use; (d) 4 = moderate importance, amount of use, appropriateness, and willingness to use; (e) 5 = moderate-high importance, amount of use, appropriateness, and willingness to use; (f) 6 = high importance, amount of use, appropriateness, and willingness to use; and (g) 7 =

highest importance, amount of use, appropriateness, and willingness to use. A seven-point Likert scale allowed for the creation of a clearer intensity similar to Thurston scaling in which "judges determine the intensities of different indicators" (Babbie, 1986, p. 395). Likert traditionally scales in five levels of intensity. The addition of two levels of intensity allows for greater variation in the responses to the variables.

The purpose of the survey was to ask technology transfer program practitioners (planners) involved in needs assessment to indicate their perceptions on: (a) the importance of each training needs assessment component to their operations, (b) the amount of use of each component in the planning procedures of the technology transfer program, (c) the appropriateness of each component and its usefulness to the technology transfer program, and (d) the technology transfer programs' willingness to use each component.

7. Demographic data were collected from the technology transfer program planners. This information included the technology transfer center planner's (a) educational background, (b) academic preparation in needs assessment, and (c) experience in needs assessment.

Chapter IV presents the findings of the survey of the 51 technology transfer programs practitioners. The survey results were assembled into a matrix. Tables and bar charts provided in Chapter IV illustrate the distribution of

ratings of the training needs assessment components by the FHWA-sponsored technology transfer program planners.

Special Procedure

One special procedure used was a positive method of dealing with nonrespondents. Because of the population size, each technology transfer program was contacted on a regular basis to encourage participation. Each of the 51 technology transfer program planners was contacted, as necessary, by phone, letter, and personal request at the annual meeting of the Transportation Research Board in January 1994 to ensure maximum participation.

Chapter IV

Analysis and Findings

The purpose of the study was to determine the components of a training needs assessment and to combine those components into a training needs assessment model. The model was developed through a Delphi process using a panel of experts. The model was rated with a survey instrument distributed to and received from the population of technology transfer program planners (practitioners). Chapter III described the procedures used to facilitate the development of the model, the study population, and the two parts of the research study.

Results of the Research Study Part I, Delphi Study

1. In early May 1993, Part I of the research was initiated with a letter sent to candidates for the panel of experts chosen by the criteria listed under the subheading Identification of Population. This letter (see Appendix D) requested the involvement of the five individuals selected by the criteria discussed under the subheading Identification of Populations and was followed by a personal phone call requesting confirmation of their willingness to participate. Each of the candidates agreed to serve on the panel.

2. A letter was sent in mid-May 1993 to the five panel members, explaining the Delphi process to be used and requesting their completion of Delphi Round 1 (see Appendix E). The open-ended questionnaire requested panel members to list the effective components of a training needs assessment. The letter was followed by a FAX (see Appendix F) requesting their responses in a timely fashion. Responses were received from all the panel members by early June 1993 (see Figure 1). Figure 1 represents the expert panel members' responses to Delphi Round 1.

3. The panel members suggested components necessary for a training needs assessment. During the first two weeks of June 1993, the researcher looked for similarities in and differences between the components suggested by the panel members and grouped the suggested components with similar themes. The researcher identified fourteen themes and wrote a subheading for each. This thematic subheading became the component subheading when the suggested components were assembled into a preliminary matrix. This preliminary matrix showed the components of a training needs assessment for technology transfer and the panel member who authored each component (see Figure 2). Figure 2 identifies the tentative headings, identified components, and each component's author.

4. The preliminary matrix was modified by the researcher to include only the major headings of conceptual

COMPONENTS OF A TRAINING NEEDS ASSESSMENT
FOR TECHNOLOGY TRANSFER

Please list the effective components of a training needs assessment model for technology transfer.

1.	*Aldridge's comments:*	*Review tasks to be accomplished.*
	Boone's comments:	*The assumption is that significant persons, who are well-informed are involved in identifying the issue. The basic idea is that the initiating agency/business entity is constantly engaged in scanning the environment of the agency/business. An established environmental scanning committee can make this part of a continuing process.*
	Cameron's comments:	*Delineation of the operational context of the needs assessment.*
	Pogue's comments:	*Determine your target audience(s): Define who exactly you will be serving. Keep in mind that you may have more than one defined target audience. For example, you may want to reach county road engineers and work crews and elected officials.*
	Sork's comments:	*The model should employ an explicit definition of "need" and should use the definition consistently.*
2.	*Aldridge's comments:*	*Review alternative ways to perform tasks.*
	Boone's comments:	*Thoroughly research the issue/problem/opportunity to acquire as much information about and to become thoroughly knowledgeable about the issue/problem/opportunity. (The assumption is that this will be accomplished by the training leader and environmental scanning committee.)*
	Cameron's comments:	*Evaluation plan (quality assurance) for the needs assessment.*
	Pogue's comments:	*Determine the problems of your target area and what your target audience can do about them: Determine what problems your state encountered and will encounter. Are your state's bridges structurally unsound? Does your target audience have any control over that issue? Determine the problems that*

Figure 1. Panel Member Responses to Round 1 Questionnaire

		your target audience can actually have an impact on. Also, look to your target area's future needs.
	Sork's comments:	*The focus of the process should be on identifying the gaps or discrepancies between current and desired capabilities of those whose needs are being assessed. The "gap" or "discrepancy" definition of need found so often i in the literature is rarely applied in needs assessment models, probably because it is much more difficult than identifying "interests" of clients or soliciting their suggestions for program topics or titles that they would like to see offered.*
3.	*Aldridge's comments:*	*Review levels of technology to accomplish tasks.*
	Boone's comments:	*Using the defined issue/problem/opportunity, study, analyze and map the target public and stakeholder groups. Study analyze, map and identify the "target public" who are a part of the issue and "stakeholder groups" who are connected to and have a stake "vested interest" in the issue and the target public and stakeholders including, but not limited to beliefs, values, goals, history, etc.*
	Cameron's comments:	*Identification of initiators of needs (problem, change, or mandate).*
	Pogue's comments:	*Assess your technology transfer environment: Find out what information, technical assistance, publications, audiovisual materials, etc. are already being used by your target audience(s).*
4.	*Aldridge's comments:*	*Review availability of new technology.*
	Boone's comments:	*Identify the leaders/spokespersons of both the target public and stakeholder groups. This processual task is important in accessing (gaining entre) into the target public and stakeholder groups. The thoughts and feelings of the leaders/spokepersons (as well as the target public itself) should be elicited about the issue or need along with their views on how the issue or need can be resolved. These influentials (leaders) often hold the key to getting the target public to cooperate. This is an initial and beginning*

Figure 1. (continued)

		dialogue with the target public (i.e. job group).
	Cameron's comments:	*Determination of barriers to improvement as perceived by all involved (e.g. hourly workers, supervisors and managers).*
	Pogue's comments:	*Determine marketing considerations: Determine what formats for training your target audience can and will accept. For example, determine whether your target audience(s) can and will attend one- or multi-day courses. What times of the year are best? What hours of the day work well? What do they like to eat for lunch? These answers will impact on the kinds of training you will offer.*
	Sork's comments:	*The model should be adaptable to a wide range of training contexts--in other words, it should be a flexible model and offer the user multiple means of approaching the assessment task.*
5.	*Aldridge's comments:*	*Review costs of the alternatives*
	Boone's comments:	*Create an appropriate setting (informal) to "interface" with leaders/spokespersons of target public and stakeholder groups. The goal is that of getting them involved in a planned exploration and discussion of the issue/problem/opportunity to identify with it and to become interested and motivated in becoming a party to its resolution.*
	Cameron's comments:	*Determination of optimal performance.*
	Pogue's comments:	*Keep abreast of new training technologies: Keep informed about the latest training technologies so that they are a factor in making decisions about training formats.*
	Sork's comments:	*The model should include a component dealing with setting priorities--that is, a process for deciding which needs will be addressed, and in which order, from those that are identified. This assumes that there will never be enough resources to address all the needs that are identified.*
6.	*Aldridge's comments:*	*Review skill levels of existing workers.*

Figure 1. (continued)

Boone's comments: *Guide the leaders/spokespersons into an in-depth study and analysis of the issue/problem/opportunity. The research should draw first upon the leaders/spokespersons' know-how and then proceed to interject external informed information (facts) as deemed appropriate into the study and analysis of the issue or need. During this process, relevant criteria such as norms, benchmarks, work standards, etc. should be collaboratively identified. Inherent within the performance of this processual task component are:*

a: *Data collection, analysis and interpretation. Numerous data collection methods exist, and the astute change agent (training and development officer) should be able to identify and select the most appropriate method for the respective issue/need. Some of these methods include surveys, interviews, observations, document studies, work sample examinations, task analysis, performance audits and appraisals, competency models, critical-incident processes, delphi procedures (such as the one you are using in your study, Danal), nominal group techniques, assessment centers, quality circles, meetings, focus groups, learning contracts, and career objectives.*

b. *Identification, assessment and analysis of needs, based on the combined judgement of the target and stakeholders and their interpretation of the data. As long as sound planning and patience are utilized, the actual collection, analysis, and interpretation of data should be fairly straight forward. However, it is important to remember that many discoveries can be made during data collection. If this happens, one should make good notes and follow up later. The researcher should not get sidetracked on these new avenues; the change agent must remain focused.*

Cameron's comments: *Determination of actual performance*

Pogue's comments: *Insure that training needs assessment is an on-going process: Make sure that your training needs assessment is constantly being updated by*

Figure 1. (continued)

		monitoring your target audience(s).
	Sork's comments:	*The model should include provision for the identification of both prescriptive (or what Houle defines as ascribed needs) and motivational (or what Houle defines as felt needs) needs.*
7.	*Aldridge's' comments:*	*Review existing skill levels to skills necessary for each alternative way to perform the tasks.*
	Boone's comments:	*Surface and articulate needs (These needs become the basis for designing a program that if implemented will fulfill the defined needs).*
	Cameron's comments:	*Problem-solving cycle (cause determination).*
	Pogue's comments:	*Above, all listen and learn: Talk with your target audience. Get to know their problems and solutions. Ask them what they need and they want.*
	Sork's comments:	*The model should include an element related to resolving differences of opinion regarding present and desired capabilities—or differences of opinion about the magnitude or even the existence of prescriptive and motivational needs.*
8.	*Aldridge's comments:*	*Identify skill deficiencies and training or new hiring necessary to acquire the required skill level for each alternative.*
	Cameron's comments:	*Determination of alternative solutions.*
	Sork's comments:	*The model should make clear what the final "product" should be of the needs assessment. That is, in unambiguous terms, it should specify what the outcome of the needs assessment will be.*
9.	*Aldridge's comments:*	*Select method to accomplish tasks and identify training needed by workers to perform the tasks.*
	Cameron's comments:	*Strategic plan for implementing findings of needs assessment. (Action plan.)*

Figure 1. (continued)

DELPHI ROUND #1

Components of a TNA for Technology Transfers

Respondents:

Mr. Wright B. Aldridge, Jr., P.E.
Dr. Edgar J. Boone
Dr. Walter A. Cameron
Ms. Lisa Pogue
Dr. Thomas J. Sork

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
1. Define Needs	The model should employ an explicit definition of "need" and should use the definition consistently.	Sork
2. Delineation of the operational context of the needs assessment	Delineation of the operational context of the needs assessment	Cameron
3. Identification of initiators of need	Identification of initiators of needs (problem, change, or mandate)	Cameron
4. Evaluate Existing Performance Levels	Review tasks to be accomplished	Aldridge
	The assumption is that significant persons, who are well-informed are involved in identifying the issue. The basic idea is that the initiating agency/business entity is constantly engaged in scanning the environment of the agency/ business. An estab-	Boone

Figure 2. Preliminary Matrix Showing Components of a Training Needs Assessment

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	lished environmental scanning committee can make this part of a continuing process.	
	Determine the problems of your target area and what your target audience can do about them: Determine what problems your state encountered and will encounter. Are your state's bridges structurally unsound? Does your target audience have any control over that issue? Determine the problems that your target audience can actually have an impact on. Also, look to your target area's future needs.	Pogue
	The focus of the process should be on identifying the gaps or discrepancies between current and desired capabilities of those whose needs are being assessed. The "gap" or "discrepancy" definition of need found so often in the literature is rarely applied in needs assessment models, probably because it is much more difficult than identifying "interests" of clients or soliciting their suggestions for	Sork

Figure 2. (continued)

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	program topics or titles that they would like to see offered.	
	Determination of actual performance.	Cameron
5. Determination of Optimal Performance	Determination of Optimal Performance.	Cameron
6. Evaluate Performance Differences	Review alternative ways to perform tasks.	Aldridge
	Review skill levels of existing workers.	Aldridge
	Review existing skill levels to skills necessary for each alternative way to perform the tasks.	Aldridge
	Identify skill deficiencies and training or new hiring necessary to acquire the required skill level for each alternative.	Aldridge
	Select method to accomplish tasks and identify training needed by workers to perform the tasks.	Aldridge
	The model should include a component dealing with setting priorities--that is, a process for deciding which needs will be addressed, and in which order, from those	Sork

Figure 2. (continued)

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	that are identified. This assumes that there will never be enough resources to address all the needs that are identified.	
	Assess your technology transfer environment: Find out what information, technical assistance, publications, audiovisual materials, etc. are already being used by your target audience(s).	Pogue
	Thoroughly research the issue/problem/opportunity to acquire as much information about and to become thoroughly knowledgeable about the issue/problem/opportunity. (The assumption is that this will be accomplished by the training leader and environmental scanning committee.)	Boone
	The model should include an element related to resolving differences of opinion regarding present and desired capabilities--or differences of opinion about the magnitude or even the existence of prescriptive and	Sork

Figure 2. (continued)

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	motivational needs.	
	The model should be adaptable to a wide range of training contexts--in other words, it should be a flexible model and offer the user multiple means of approaching the assessment task.	Sork
7. Problem solving cycle (cause determination)	Problem solving cycle (cause determination)	Cameron
8. Determination of alternative solutions	Determination of alternative solutions	Cameron
9. Evaluate Existing Technology	Keep abreast of new training technologies: Keep informed about the latest training technologies so that they are a factor in making decisions about training formats.	Pogue
	Review levels of technology to accomplish tasks.	Aldridge
	Review availability of new technology.	Aldridge
	The model should include provision for the identification of both prescriptive (or what Houle defines as ascribed needs) and motivational (or what	Sork

Figure 2. (continued)

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	Houle defines as felt needs) needs.	
10. Identify Target Audience	Determine your target audience(s): Define who exactly you will be serving. Keep in mind that you may have more than one defined target audience. For example, you may want to reach county road engineers and work crews and elected officials.	Pogue
	Determine marketing considerations: Determine what formats for training your target audience can and will accept. For example, determine whether your target audience(s) can will attend one- or multi-day courses. What times of the year are best? What hours of the day work well? What do they like to eat for lunch? These answers will impact on the kinds of training you will offer.	Pogue
	Study, analyze, map and identify the "target public: who are a part of the issue and "stakeholder groups" who are connected to and have a stake "vested interest" in the issue and the target	Boone

Figure 2. (continued)

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	public. This is a critical element in a needs assessment model. Considerable study and effort should be expended to learn who is being or will be impacted by the issue or need along with all relevant information pertaining to the target public and stakeholders including, but not limited to beliefs, values, goals, history, etc.	
11. Encourage Participation	Above all, listen and learn: Talk with your target audience. Get to know their problems and solutions. Ask them what they need and they want.	Pogue
	This processual task is important in accessing (gaining entre) into the target public and stakeholder groups. The thoughts and feelings of the leaders/spokespersons (as well as the target public itself) would be elicited about the issue or need along with their views on how the issue or need can be resolved. These influentials (leaders) often hold the key to getting the target public to cooperate. This is an	Boone

Figure 2. (continued)

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	initial and beginning dialogue with the target public (i.e. job group).	
	The goal is that of getting them involved in a planned exploration and discussion of the issue/problem/opportunity to identify with it and to become interested and motivated in becoming a party to its resolution.	Boone
	The researcher should draw first upon the leaders/spokepersons' know-how and then proceed to interject external informed information (facts) as deemed appropriate into the study and analysis of the issue or need. During this process, relevant criteria such as norms, benchmarks, work standards, etc. should be collaboratively identified. Inherent within the performance of this processual task component are:	Boone
	a. Data collection, analysis and interpretation. Numerous data collection methods exist, and the	

Figure 2. (continued)

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	astute change agent (training and development officer) should be able to identify and select the most appropriate method for the respective issue/need. Some of these methods include surveys, interviews, observations, document studies, work sample examinations, task analysis, performance audits and appraisals, competency models, critical-incident processes, delphi procedures (such as the one you are using in your study, Danal), nominal group techniques, assessment centers, quality circles, meetings, focus groups, learning contracts, and career objectives.	
	b. Identification, assessment and analysis of needs, based on the combined judgement of the target and	

Figure 2. (continued)

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	stakeholders and their interpretation of the data. As long as sound planning and patience are utilized, the actual collection, analysis, and interpretation of data should be fairly straight forward. However, it is important to remember that many discoveries can be made during data collection. If this happens, one should make good notes and follow up later. The researcher should not get sidetracked on these new avenues; the change agent must remain focused.	
	Determination of barriers to improvement as perceived by all involved (e.g. hourly workers, supervisors and managers).	Cameron
12. Evaluate costs	Review costs of the alternatives	Aldridge
13. Summarize Information	The model should make clear what the final "product" should be of	Pogue

Figure 2. (continued)

TENTATIVE HEADING	IDENTIFIED COMPONENT	COMPONENT AUTHOR
	the needs assessment. That is, in unambiguous terms, it should specify what the outcome of the needs assessment will be.	
	Surface and articulate needs (These needs become the basis for designing a program that if implemented, will fulfill the defined needs).	Boone
	Strategic plan for implementing findings of needs assessment. (Action plan.)	Cameron
14. Evaluate and Control	Insure that training needs assessment is an on-going process: Make sure that your training needs assessment is constantly being updated by monitoring your target audience(s).	Pogue
	The model should include criteria for assessing the quality of needs assessment--that is, what standards should be applied to judge whether the needs assessment has been a "good" one.	Sork
	Evaluation plan (quality assurance) for the needs assessment.	Cameron

Figure 2. (continued)

components and systems components, the component subheadings developed by the researcher in Step 3, and the components suggested by the panel members. The component author names were excluded in the modified matrix to prevent bias on behalf of the panel member authors in evaluating the developing model (see Figure 3).

5. A cover letter (see Appendix G) and the modified matrix (see Figure 3) were sent to the panel of experts in late June 1993. Panel members were asked to review the matrix and to make any changes in the assignment of major headings and subheadings or in the wording of the components. Round 2 of the Delphi process took considerable time due to the summer months and the unavailability of some members of the panel of experts to work on the project. The Round 2 matrix was returned by all members of the panel of experts by mid-July 1993. All panel members made comments on and/or revisions to the modified matrix.

The Round 2 mailing also included an approval form for the panel members to sign and to make general comment(see Figure 4). Three panel members made general comments on the form when signing and two signed without making comments.

6. The panel member comments on and revisions to the Round 2 modified matrix were reviewed by the researcher. The panel member comments and revisions are presented in Figure 5 and are identified by the panel member making the comment or revision.

DELPHI ROUND #2

Components of a TNA for Technology Transfers

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
1. Conceptual components	Define the term "Need"	The model should employ an explicit definition of "need" and should use the definition consistently.
	Determine the setting for the needs assessment	Delineation of the operational context of the needs assessment
	Identify the initiators of need	Identification of initiators of needs (problem, change, or mandate)
	Evaluate Existing Performance Levels	Review tasks to be accomplished
		The assumption is that significant persons, who are well-informed are involved in identifying the issue. The basic idea is that the initiating agency/business entity is constantly engaged in scanning the environment of the agency/ business. An environmental scanning committee can make this part of a continuing process.
		Determine the problems of your target area and what your target

Figure 3. Modified Matrix Showing Components of a Training Needs Assessment

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
		audience can do about them: Determine what problems your state encountered and will encounter. Are your state's bridges structurally unsound? Does your target audience have any control over that issue? Determine the problems that your target audience can actually have an impact on. Also, look to your target area's future needs.
		The focus of the process should be on identifying the gaps or discrepancies between current and desired capabilities of those whose needs are being assessed. The "gap" or "discrepancy" definition of need found so often in the literature is rarely applied in needs assessment models, probably because it is much more difficult than identifying "interests" of clients or soliciting their suggestions for program topics or titles that they would like to see offered. Determination of actual performance.

Figure 3. (continued)

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
	Determination of optimal performance	Determination of Optimal Performance.
	Evaluate performance differences	Review alternative ways to perform tasks.
		Review skill levels of existing workers.
		Review existing skill levels to skills necessary for each alternative way to perform the tasks.
		Identify skill deficiencies and training or new hiring necessary to acquire the required skill level for each alternative.
		Select method to accomplish tasks and identify training needed by workers to perform the tasks.
		The model should include a component dealing with setting priorities--that is, a process for deciding which needs will be addressed, and in which order, from those that are identified. This assumes that there will never be enough resources to address all the needs that are identified.

Figure 3. (continued)

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
		Assess your technology transfer environment: Find out what information, technical assistance, publications, audiovisual materials, etc. are already being used by your target audience(s).
		Thoroughly research the issue/problem/opportunity to acquire as much information about and to become thoroughly knowledgeable about the issue/problem/opportunity. (The assumption is that this will be accomplished by the training leader and environmental scanning committee.)
		The model should include an element related to resolving differences of opinion regarding present and desired capabilities--or differences of opinion about the magnitude or even the existence of prescriptive and motivational needs.
		The model should be adaptable to a wide range of training contexts--in other

Figure 3. (continued)

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
		words, it should be a flexible model and offer the user multiple means
	Problem solving cycle	of approaching the assessment task.
		Problem solving cycle
	Determine alternative solutions	
		Determination of
	Evaluate existing technology	alternative solutions
		Keep abreast of new training technologies: Keep informed about the latest training technologies so that they are a factor in making decisions about training formats.
		Review levels of technology to accomplish tasks.
		Review availability of new technology.
		The model should include provision for the identification of both prescriptive (or what Houle defines as ascribed needs) and motivational (or what
		Houle defines as felt needs) needs.

Figure 3. (continued)

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
10. Systems Components	Identify target audience	
		Determine your target audience(s): Define who exactly you will be serving. Keep in mind that you may have more than one defined target audience. For example, you may want to reach county road engineers and work crews and elected officials.
		Determine marketing considerations: Determine what formats for training your target audience can and will accept. For example, determine whether your target audience(s) can will attend one- or multi-day courses. What times of the year are best? What hours of the day work well? What do they like to eat for lunch? These answers will impact on the kinds of training you will offer.
		Study, analyze, map and identify the "target public: who are a part of the issue and "stakeholder groups" who are connected to and have a stake "vested interest" in the issue and the target

Figure 3. (continued)

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
		public. This is a critical element in a needs assessment model. Considerable study and effort should be expended to learn who is being or will be impacted by the issue or need along with all relevant information pertaining to the target public and stakeholders including, but not limited to beliefs, values, goals, history, etc.
	Encourage participation	Above all, listen and learn: Talk with your target audience. Get to know their problems and solutions. Ask them what they need and they want.
		This processual task is important in accessing (gaining entre) into the target public and stakeholder groups. The thoughts and feelings of the leaders/spokespersons (as well as the target public itself) would be elicited about the issue or need along with their views on how the issue or need can be resolved. These influentials (leaders) often hold the key to getting the target public

Figure 3. (continued)

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
		to cooperate. This is an initial and beginning dialogue with the target public (i.e. job group). The goal is that of getting them involved in a planned exploration and discussion of the issue/problem/opportunity to identify with it and to become interested and motivated in becoming a party to its resolution. The researcher should draw first upon the leaders/spokepersons' know-how and then proceed to interject external informed information (facts) as deemed appropriate into the study and analysis of the issue or need. During this process, relevant criteria such as norms, benchmarks, work standards, etc. should be collaboratively identified. Inherent within the performance of this processual task component are: a. Data collection, analysis and interpretation. Numerous data collection methods

Figure 3. (continued)

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
		exist, and the astute change agent (training and development officer) should be able to identify and select the most appropriate method for the respective issue/need. Some of these methods include surveys, interviews, observations, document studies, work sample examinations, task analysis, performance audits and appraisals, competency models, critical-incident processes, delphi procedures (such as the one you are using in your study, Danal), nominal group techniques, assessment centers, quality circles, meetings, focus groups, learning contracts, and career objectives.
		b. Identification, assessment and analysis of needs, based on the combined judgement of the target

Figure 3. (continued)

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
		andstakeholders and their interpretation of the data. As long as sound planning and patience are utilized, the actual collection, analysis, and interpretation of data should be fairly straight forward. However, it is important to remember that many discoveries can be made during data collection. If this happens, one should make good notes and follow up later. The researcher should not get sidetracked on these new avenues; the change agent must remain focused.
	Evaluate costs	Determination of barriers to improvement as perceived by all involved (e.g. hourly workers, supervisors and managers).
	Summarize information	Review costs of the alternatives The model should make clear what the final "product" should be of

Figure 3. (continued)

MAJOR HEADING	SUBHEADING	IDENTIFIED COMPONENT
		the needs assessment. That is, in unambiguous terms, it should specify what the outcome of the needs assessment will be.
		Surface and articulate needs (These needs become the basis for designing a program that if implemented, will fulfill the defined needs).
	Evaluate and control	Strategic plan for implementing findings of needs assessment. (Action plan.)
		Insure that training needs assessment is an on-going process: Make sure that your training needs assessment is constantly being updated by monitoring your target audience(s).
		The model should include criteria for assessing the quality of needs assessment--that is, what standards should be applied to judge whether the needs assessment has been a "good" one.
		Evaluation plan (quality assurance) for the needs assessment.

Figure 3. (continued)

COMMENTS

OR

ADDITIONS

Aldridge's comments:	***I am unclear on the distinction between Conceptual Planning as displayed in the attachment. Perhaps, the vision will clear as we proceed forward.***
Boone's comments:	***Thank you for sharing your preliminary "Needs" model with me. It is excellent.***
Sork's comments:	***Danal - You have done a good job of incorporating my views into the "components." I couldn't resist working a few comments in the listing, but I know I'll get my chance to support/assess the contents of others in the next round.***

APPROVE
AS
CATAGORIZED

PRINT NAME	INITIAL
	s/ Wright Aldridge
	s/ Edgar J. Boone
	s/ Lisa Pogue
	s/ T. J. Sork
	s/ Walter A. Cameron

Figure 4. Approval Form for Modified Matrix

During Round 2 of the Delphi process, one of the experts arranged the components into five major headings and eliminated the two major headings proposed by the researcher. The major headings were as follows: (a) context evaluation, (b) input evaluation, (c) process evaluation, (d) product evaluation, and (e) impact evaluation. These five major headings were used by the researcher when combining the components into a diagram of the preliminary model. The resulting diagram was designed to include the major components identified and delineated by the panel of experts. Special care was taken to ensure that each panel member's input was included in the diagram. Figure 6 presents the components identified by the panel members and assembled into a diagram of the preliminary model.

7. In early September 1993 a cover letter (see Appendix H) was sent along with the diagram of the preliminary model to the panel of experts. A form was included with the letter and diagram to ask each of the panel members to comment on or approve the preliminary model (see Figure 7). After reviewing the diagram of the preliminary model, three of the experts made comments but approved the preliminary model without revision, one panel member approved the preliminary model without comment, and one panel member sent a FAX to the researcher requesting that the names of the headings of the phases be changed due

Aldridge's Comments and Revisions

On page 3
Major Heading: Conceptual components
Subheading: Evaluate performance differences

Evaluate performance differences	Review alternative ways to perform tasks.
	Review skill levels of existing workers.
Rename: Identify performance deficiencies (training needs).	Review existing skill levels to skills necessary for each alternative way to perform the tasks.
	Identify skill deficiencies and training or new hiring necessary to acquire the required skill level for each alternative.
	Select method to accomplish tasks and identify training needed by workers to perform the tasks.
Good	The model should include a component dealing with setting priorities--that is, a process for deciding which needs will be addressed, and in which order, from those that are identified. This assumes that there will never be enough resources to address all the needs that are identified.

Figure 5. Panel Member Responses to Round 2

On page 6
Major Heading: Systems Components
Subheading: Identify target audience

10.	Systems Components	Identify target audience ***each audience type will require different levels of detail for the subject area.***	Determine your target audience(s): Define who exactly you will be serving. Keep in mind that you may have more than one defined target audience. For example, you may want to reach county road engineers and work crews and elected officials.

On pages 10 and 11
Major Heading: Systems Components
Subheading: Summarize information

		Summarize information *Good*	The model should make clear what the final "product" should be of the needs assessment. That is, in unambiguous terms, it should specify what the outcome of the needs assessment will be.

Figure 5. (continued)

Boone's Comments and Revisions

On page 1
Major Heading: Conceptual components
Subheading: Evaluate Existing Performance Levels

Evaluate Existing Performance Levels	Review tasks to be accomplished
My concern is that you might want to add in a component on "environmental scanning." This is a Critical, On-going task that keeps an organization in track with focus that are or will impact on employment and training needs for additional training.	The assumption is that significant persons, who are well-informed are involved in identifying the issue. The basic idea is that the initiating agency/business entity is constantly engaged in scanning the environment of the agency/ business. An environmental scanning committee can make this part of a continuing process.

Figure 5. (continued)

Cameron's Comments and Revisions

On page 1
Major Heading: Conceptual components
Subheading: Multiple subheadings

	A. Context Evaluation	
1. Conceptual Components	*1.* Define the term "Need"	The model should employ an explicit definition of "need" and should use the definition consistently.
	2. Determine the setting for the needs assessment	Delineation of the operational context of the needs assessment
	3. Identify the initiators of need	Identification of initiators of needs (problem, change, or mandate)
	4. Evaluate Existing Performance Levels	Review tasks to be accomplished

On page 1
Major Heading: Conceptual components
Subheading: Multiple subheadings

	B. Input Evaluation	
	1. Determination of optimal performance	Determination of Optimal Performance.
	2. Evaluate performance differences	Review alternative ways to perform tasks. Review skill levels of existing workers.
	3. Identify objectives of needs assessment	Review existing skill levels to skills necessary for each alternative way to perform the tasks.

Figure 5. (continued)

On page 5
Major Heading: Conceptual components
Subheading: Multiple subheadings

C. Process Evaluation	
Problem solving cycle	Problem solving cycle
Determine alternative solutions	Determination of alternative solutions
Evaluate existing technology	Keep abreast of new training technologies: Keep informed about the latest training technologies so that they are a factor in making decisions about training formats.

On page 6
Major Heading: Systems Components
Subheading: Identify target audience

A. Context Evaluation	
1. Identify target audience ***Under conceptual components***	Determine your target audience(s): Define who exactly you will be serving. Keep in mind that you may have more than one defined target audience. For example, you may want to reach county road engineers and work crews and elected officials.

Figure 5. (continued)

On page 7
Major Heading: Systems Components
Subheading: Encourage participation

C. Process Evaluation *1.* Encourage participation	Above all, listen and learn: Talk with your target audience. Get to know their problems and solutions. Ask them what they need and they want.

On page 10
Major Heading: Systems Components
Subheading: Multiple subheadings

D. Product Evaluation	
1. Evaluate costs	Review costs of the alternatives
2. Summarize information	The model should make clear what the final "product" should be of the needs assessment. That is, in unambiguous terms, it should specify what the outcome of the needs assessment will be.

On page 11
Major Heading: Systems Components
Subheading: Evaluate and control

~~Evaluate and control~~ ***Must be integrated throughout - not an add-on at end***	Insure that training needs assessment is an on-going process: Make sure that your training needs assessment is constantly being updated by monitoring your target audience(s).

Figure 5. (continued)

Pogue's Comments and Revisions

On page 1
Major Heading: Conceptual components
Subheading: Evaluate Existing Performance Levels

Ideal situation, however, many times these people are interested in their own interests, needs, desires, etc.

The assumption is that significant persons, who are well-informed are involved in identifying the issue. The basic idea is that the initiating agency/business entity is constantly engaged in scanning the environment of the agency/ business. An environmental scanning committee can make this part of a continuing process.

On page 2
Major Heading: Conceptual components
Subheading: Evaluate Existing Performance Levels

Yes, you're right

The focus of the process should be on identifying the gaps or discrepancies between current and desired capabilities of those whose needs are being assessed. The "gap" or "discrepancy" definition of need found so often in the literature is rarely applied in needs assessment models, probably because it is much more difficult than identifying "interests" of clients or soliciting their suggestions for program

Figure 5. (continued)

topics or titles that they would like to see offered.

On page 3
Major Heading: Conceptual components
Subheading: Evaluate performance differences

	Evaluate performance differences	Review alternative ways to perform tasks.
		Review skill levels of existing workers.
		Review existing skill levels to skills necessary for each alternative way to perform the tasks.
	It is not only the workers who determine successful technology transfer. Also need to look to regulations, state laws, practices, specifications, equipment, etc.	Identify skill deficiencies and training or new hiring necessary to acquire the required skill level for each alternative.
		Select method to accomplish tasks and identify training needed by workers to perform the tasks.
		The model should include a component dealing with setting priorities--that is, a process for deciding which needs will be addressed, and in which order, from those that are identified. This assumes that there will never be enough resources to address all the needs that are identified.

Figure 5. (continued)

On page 5
Major Heading: Conceptual components
Subheading: Evaluate existing technology

Evaluate existing technology	Keep abreast of new training technologies: Keep informed about the latest training technologies so that they are a factor in making decisions about training formats.
Also, keep abreast of current research and innovative products, equipment, methods, etc.	Review levels of technology to accomplish tasks.
	Review availability of new technology.
	The model should include provision for the identification of both prescriptive (or what Houle defines as ascribed needs) and motivational (or what Houle defines as felt needs) needs.

On page 11
Major Heading: Systems Components
Subheading: Evaluate and control

Evaluate and control	Insure that training needs assessment is an on-going process: Make sure that your training needs assessment is constantly being updated by monitoring your target audience(s).
Important	

Figure 5. (continued)

Sork's Comments and Revisions

On page 2
Major Heading: Conceptual components
Subheading: Evaluate Existing Performance Levels

	To clarify the issue a bit more, the process should include a component in which the planners distinguish between "training needs" and "Non-training" needs, or more accurately, those needs for which training is at least part of the required intervention from those needs for which training will play no part.	The focus of the process should be on identifying the gaps or discrepancies between current and desired capabilities of those whose needs are being assessed. The "gap" or "discrepancy" definition of need found so often in the literature is rarely applied in needs assessment models, probably because it is much more difficult than identifying "interests" of clients or soliciting their suggestions for program topics or titles that they would like to see offered. Determination of actual performance.

On page 3
Major Heading: Conceptual components
Subheading: Multiple subheadings

I consider this the same as identifying "desired capabilities" on previous page.	Determination of optimal performance	Determination of Optimal Performance.
	Evaluate performance differences	Review alternative ways to perform tasks.
	Same as Determine present capabilities on previous page.	Review skill levels of existing workers.

Figure 5. (continued)

	Not a "Training need."	Identify skill deficiencies and training or new hiring necessary to acquire the required skill level for each alternative.

On page 5
Major Heading: Conceptual components
Subheading: Evaluate existing technology

	Evaluate existing technology	Keep abreast of new training technologies: Keep informed about the latest training technologies so that they are a factor in making decisions about training formats.
	These components seem to go beyond needs assessment as I understand it. They seem to be issues related to program designing, but I guess I'll get my chance to assess in the next round.	Review levels of technology to accomplish tasks. Review availability of new technology. The model should include provision for the identification of both prescriptive (or what Houle defines as ascribed needs) and motivational (or what Houle defines as felt needs) needs.

Figure 5. (continued)

On pages 6 and 7
Major Heading: Systems Components
Subheading: Identify target audience

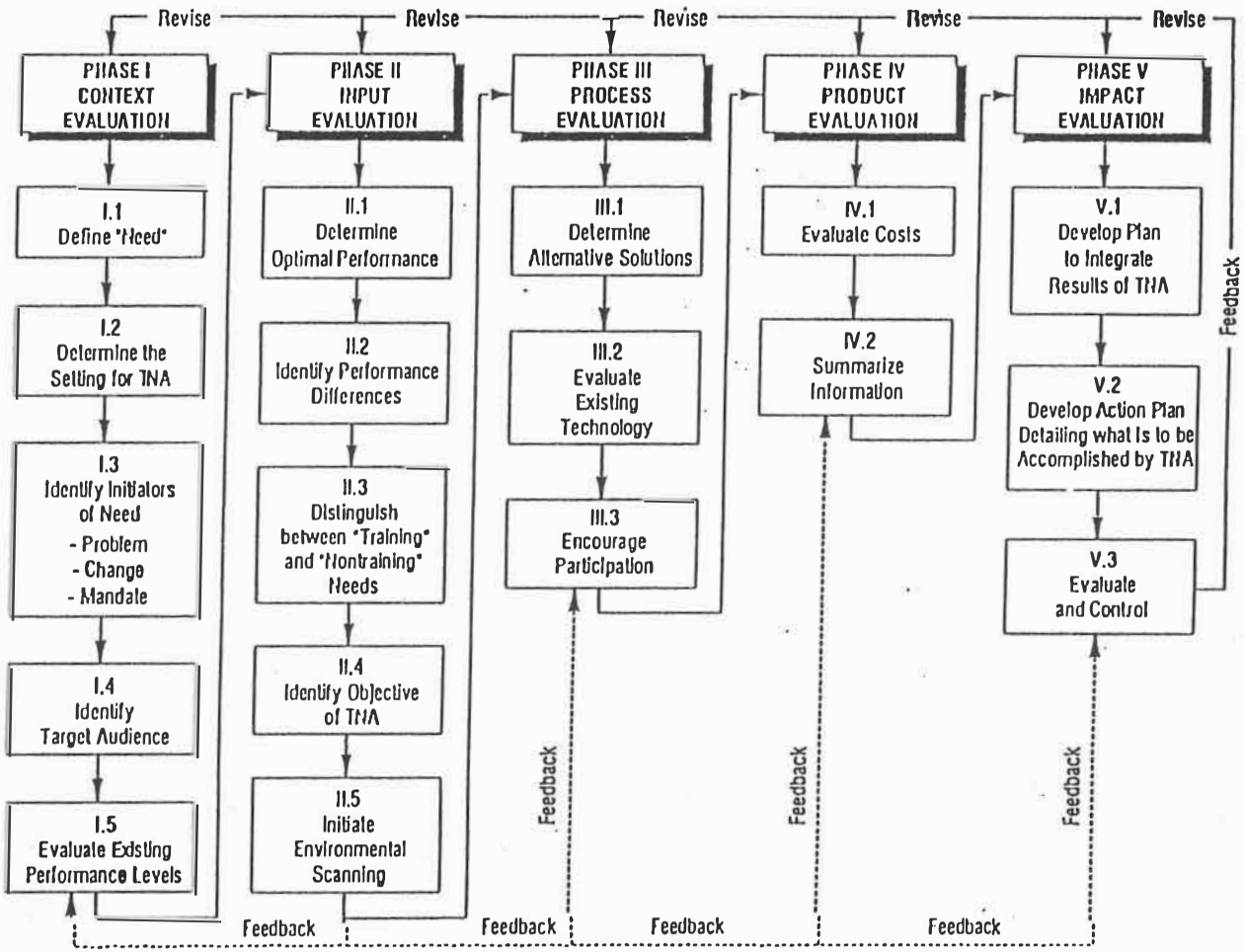
10.	Systems Components	Identify target audience	Determine your target audience(s): Define who exactly you will be serving. Keep in mind that you may have more than one defined target audience. For example, you may want to reach county road engineers and work crews and elected officials. Determine marketing considerations: Determine what formats for training your target audience can and will accept. For example, determine whether your target audience(s) can will attend one- or multi-day courses. What times of the year are best? What hours of the day work well? What do they like to eat for lunch? These answers will impact on the kinds of training you will offer.

I'd like to reinforce these points. I always assume that a "conceptual analysis" and "client system" analysis procedes a needs assessment, so I assume the "target audience" is well defined and understood.

Figure 5. (continued)

		Study, analyze, map and identify the "target public: who are a part of the issue and "stakeholder groups" who are connected to and have a stake "vested interest" in the issue and the target public. This is a critical element in a needs assessment model. Considerable study and effort should be expended to learn who is being or will be impacted by the issue or need along with all relevant information pertaining to the target public and stakeholders including, but not limited to beliefs, values, goals, history, etc.
	Ditto Above	

Figure 5. (continued)



Training Needs Assessment (TNA) for Technology Transfer (TNATT)
Context, Input, Process, Product, Impact CIPPI Model

Figure 6. Diagram of the Preliminary Model

COMMENTS

OR

ADDITIONS

Aldridge's comments:	***I have no additional comments.***
Boone's comments:	***Your model is excellent!! It is substantive, logically organized, and comprehensivell***
Pogue's comments:	***Regarding II.3 - "Non-training" needs may be as or more important to the technology transfer process than "training" needs. These "non-training" needs should also be considered along with, as a supplement to, training efforts. Looks good.***

Approval:

NAME	INITIAL
s/Wright B. Aldridge, Jr.	
s/Edgar J. Boone	
s/Walter A. Cameron	
s/Lisa Pogue	
Thomas J. Sork approved via telephone conditional on the changing of the labeling of the phases	

Figure 7. Approval Form for Preliminary Model

to a potential conflict. The same heading names had appeared in a model on program evaluation. The researcher made the suggested changes in the headings of the phases of the preliminary training needs assessment model. The changes in the headings of the phases were enhanced by using a thesaurus to find terminology compatible with the original phases labeled: (a) context evaluation, (b) input evaluation, (c) process evaluation, (d) product evaluation, and (e) impact evaluation. The phases were renamed: (a) background, (b) investigation, (c) implications, (d) outcome, and (e) impact. The fifth member of the panel of experts approved the preliminary model by phone after the changes in phase headings. A letter was sent to all panel members explaining the reason for the change in the phase headings (see Appendix I). The phases of the model were revised and each member of the panel of experts was requested to review the new phase headings and report any comment or disagreement. None of the panel members reported any disagreement with the changes in the phase headings. The model was adopted as amended by the panel of experts in the third and final round of the Delphi study. A copy of the final model is shown in Figure 8.

8. Following Round 3 of the Delphi process the researcher, in conjunction with the panel of experts, developed the Training Needs Assessment for Technology Transfer Model. The model is divided into five phases:

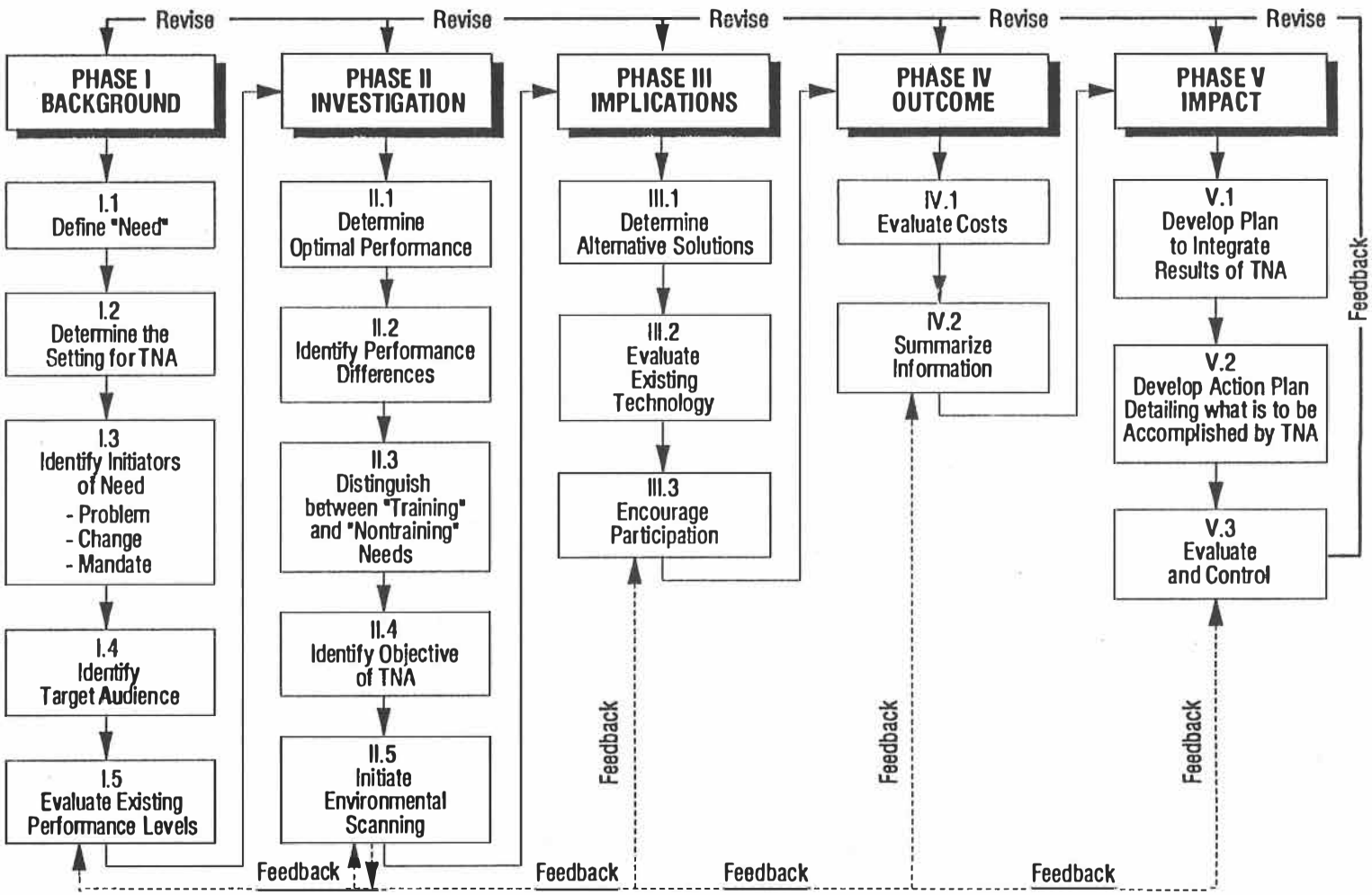


Figure 8. Training Needs Assessment for Technology Transfer Model

(I) background, (II) investigation, (III) implications, (IV) outcome, and (V) impact. Figure 9 shows each of these phases, components, definitions, and the panel member(s) who developed or assisted in developing the identified component. This figure illustrates the recommended relationship of the five phases and the eighteen components. Figure 8 (p. 93) provides a sequential portrayal of the inter-workings and relationships between the phases and components which are tied together with a feedback loop from two of the components. Symbolically this figure illustrates the recommended relationships of the five phases and 18 components. The components of the model are depicted in a linear sequence.

The components within the phase and definitions of the components are explained in a narrative under each of the following headings. The panel members who developed or assisted in developing each component are identified.

Phase I, Background

Phase I, Background, establishes the "conditions or events forming a setting" (American Heritage Dictionary, 1983, p. 50) for the training needs assessment process. The components of Phase I were developed by the panel of experts as follows.

DELPHI ROUND #3
Phases, Components, Definitions and Authors

PHASE	COMPONENT	DEFINITION	DELPHI PANEL MEMBER
PHASE 1 BACKGROUND	1. Define "Need"	The model should employ an explicit definition of "need" and should use the definition consistently.	Sork
	2. Determine the Setting for TNA	Delineation of the operational context of the needs assessment	Cameron
	3. Identify the Initiators of Need	Identification of initiators of needs (problem,change, or mandate)	Cameron
	4. Identify Target Audience	Determine your target audience(s): Define who exactly you will be serving. Keep in mind that you may have more than one defined target audience. For example, you may want to reach county road engineers and work crews and elected officials. Determine marketing considerations: Determine what format for training your target audience can and will accept. For example, determine whether your target audience(s) can/will attend one- or multi-day courses. What times of the year are best? What hours of the day work well? What do they like to eat for lunch? These answers will impact on the kinds of training you will offer.	Pogue

Figure 9. Phases, Components, Definitions, and Authors.

	4. Identify Target Audience (cont'd)	Study, analyze, map and identify the "target public: who are a part of the issue and "stakeholder groups" who are connected to and have a stake "vested interest" in the issue and the target public. This is a critical element in needs assessment model. Considerable study and effort should be expended to learn who is being or will be impacted by the issue or need along with all relevant information pertaining to the target public and stakeholders including, but not limited to beliefs, values, goals, history, etc.	Boone
	5. Evaluate Existing Performance Levels	Review tasks to be accomplished.	Aldridge
		Determine the problems of your target area and what your target audience can do about them: Determine what problems your state encountered and will encounter. Are your state's bridges structurally unsound? Does your target audience have any control over that issue? Determine the problems that your target audience can actually have an impact on. Also, look to your target area's future needs.	Pogue

Figure 9. (continued)

	5. Evaluate Existing Performance Levels (cont'd)	The focus of the process should be on identifying the gaps or discrepancies between current and desired capabilities of those whose needs are being assessed The "gap" or "discrepancy" definition of need found so often in the literature is rarely applied in needs assessment models, probably because it is much more difficult than identifying "interests" of clients or soliciting their suggestions for program topics or titles that they would like to see offered.	Sork

Figure 9. (continued)

PHASE II INVESTIGATION	1. Determine Optimal Performance	Determination of optimal performance.	Cameron
		Review alternative ways to perform tasks.	Aldridge
	2. Evaluate Performance Differences	Review skill levels of existing workers.	Aldridge
		Review existing skill levels to skills necessary for each alternative way to perform the tasks.	Aldridge
		Identify skill deficiencies and training or new hiring necessary to acquire the required skill level for each alternative.	Aldridge
	3. Distinguish Between "Training" and "Nontraining" Needs	The model should include an element related to resolving differences of opinion regarding present and desired capabilities--or differences of opinion about the magnitude or even the existence of prescriptive and motivational needs. The process should include a component in which the planners distinguish between "training needs" and "non-training" needs for which training is at least a part of the required intervention from those needs for which training will play no part.	Sork

Figure 9. (continued)

	4. Identify Objective of TNA	The model should include a component dealing with setting priorities--that is, a process for deciding which needs will be addressed, and in which order, from those that are identified. This assumes that there will never be enough resources to address all the needs that are identified.	Sork
		Assess your technology transfer environment: Find out what information, technical assistance, publications, audiovisual materials, etc. are already being used by your target audience(s). The model should be adaptable to a wide range of training contexts--in other words, it should be a flexible model and offer the user multiple means of approaching the assessment task. The model should be adaptable to a wide range of training contexts--in other words, it should be a flexible model and offer the user multiple means of approaching the assessment task.	Pogue
		Select method to accomplish tasks and identify training needed by workers to perform the tasks.	Aldridge
	5. Initiate Environmental Scanning	Thoroughly research the issue/problem/opportunity to acquire as much information about and to become thoroughly knowledgeable about the issue/problem/opportunity. (The assumption is that this will be accomplished by the training leader and environmental scanning committee).	Boone

Figure 9. (continued)

PHASE III IMPLICATIONS	1. Determine Alternative Solutions	Determination of alternative solutions.	Cameron
	2. Evaluate Existing Technology	Keep abreast of new training technologies: Keep informed about the latest training technologies so that they are a factor in making decisions about training formats.	Pogue
		Review availability of new technology. Review levels of technology to accomplish tasks.	Aldridge
		The model should include provision for the identification of both prescriptive (or what Houle defines as ascribed needs) and motivational (or what Houle defines as felt needs) needs.	Sork
	3. Encourage Participation	Above all, listen and learn: Talk with your target audience. Get to know their problems and solutions. Ask them what they need and they want.	Pogue

Figure 9. (continued)

	3. Encourage Participation (cont'd)	This processual task is important in accessing (gaining entre) into the target public and stakeholder groups. The thoughts and feelings of the leaders/ spokesperson (as well as the target public itself) would be elicited about the issue or need along with their views on how the issue or need can be resolved. These influentials (leaders) often hold the key to getting the target public to cooperate. This is an initial and beginning dialogue with the target public (i.e. job group). The goal is that of getting them involved in a planned exploration and discussion of the issue/problem/ opportunity to identify with it and to become interested and motivated in becoming a party to its resolution.	Boone

Figure 9. (continued)

PHASE IV OUTCOME	1. Evaluate Costs	Review costs of the alternatives	Aldridge
	2. Summarize Information	The model should make clear what the final "product" should be of the needs assessment. That is, in unambiguous terms, it should specify what the outcome of the needs assessment will be.	Pogue
		Surface and articulate needs (these needs become the basis for designing a program that if implemented, will fulfill the defined needs).	Boone

Figure 9. (continued)

PHASE V IMPACT	1. Develop Plan to Integrate Results of TNA	The researcher should draw first upon the leaders/spokepersons' know-how and then proceed to interject external informed information (facts) as deemed appropriate into the study and analysis of the issue or need. During this process, relevant criteria such as norms, benchmarks, work standards, etc. should be collaboratively identified. Inherent within the performance of this processual task component are: a. Data collection, analysis and interpretation. Numerous data collection methods exist, and the astute change agent (training and development officer) should be able to identify and select the most appropriate method for the respective issue/need. Some of these methods include surveys, interviews, observations, document studies, work sample, examinations, task analysis, performance audits and appraisals, competency models, critical-incident processes, delphi procedures nominal group techniques, assessment centers, quality circles, meetings, focus groups, learning contracts, and career objectives. b. Identification, assessment and analysis of needs, based on the combined judgement of the target and stakeholders and their interpretation of the data.	Boone

Figure 9. (continued)

	1. Develop Plan to Integrate Results of TNA (cont'd)	As long as sound planning and patience are utilized, the actual collection, analysis and interpretation of data should be fairly straight forward. However, it is important to remember that many discoveries can be made during data collection. If this happens, one should make good notes and follow up later. The researcher should not get sidetracked on these new avenues; the change agent must remain focused.	
	2. Develop Action Plan Detailing What is to be Accomplished by TNA	Strategic plan which integrate results of needs assessment. Action plan detailing what is to be accomplished to meet needs	Cameron
	3. Evaluate and Control	Insure that training needs assessment is an on-going process: Make sure that your training needs assessment is constantly being updated by monitoring your target audience(s).	Pogue
		The model should include criteria for assessing the quality of needs assessment--that is, what standards should be applied to judge whether the needs assessment has been a "good" one.	Sork
		Evaluation plan (quality assurance) for the needs assessment.	Cameron

Figure 9. (continued)

Component I.1, Define "Need". The first procedural component in the model is to define the term "need." Dr. Sork described this component. "The model should employ an explicit definition of 'need' and should use the definition consistently."

Component I.2, Determine the Setting for Training Needs Assessment (TNA). Dr. Cameron contributed this component and defined it as the "delineation of the operational context of the needs assessment."

Component I.3, Identify Initiators of Need. Dr. Cameron contributed this component and wrote that the model should begin with the "identification of initiators of needs (problem, change, mandate)."

Component I.4, Identify Target Audience. Ms. Pogue was instrumental in the inclusion of this component and contributed two definitions related to identifying the target audience. The first definition was:

> Determine your target audience(s): Define who exactly you will be serving. Keep in mind that you may have more than one defined target audience. For example, you may want to reach county road engineers and work crews and elected officials.

The second definition was related to marketing:

Determine marketing considerations: Determine what formats for training your target audience can and will accept. For example, determine whether your target audience(s) can/will attend one or multi-day courses. What times of the year are best? What hours of the day work well? What do they like to eat for lunch? These answers will impact on the kinds of training you will offer.

Dr. Boone expanded on the definition by adding the following information:

Study, analyze, map, and identify the "target public" who are part of the issue and "stakeholder groups" who are connected to and have a stake "vested interest" in the issue and the target public. This is a critical element in the needs assessment model. Considerable study and effort should be expended to learn who is being or will be impacted by the issue or need along with all relevant information pertaining to the target public and stakeholders including, but not limited to beliefs, values, goals, history, etc.

Component I.5, Evaluate Existing Performance Levels.

Three members of the panel of experts suggested this component. Mr. Aldridge phrased this component as "review tasks to be accomplished." Ms. Pogue wrote that the model should:

> Determine the problems of your target area and what your target audience can do about them. Determine what problems your state encountered and will encounter. Are your state's bridges structurally unsound? Does your target audience have any control over that issue? Determine the problems that your audience can actually have an impact on. Also, look to your target area's future needs.

This component was summarized by Dr. Sork who added:

> The focus of the process should be on identifying the gaps or discrepancies between current and desired capabilities of those whose needs are being assessed. The "gap" or "discrepancy" definition of need found so often in the literature is rarely applied in needs assessment models, probably because it is much more difficult than identifying "interests" of clients or soliciting their suggestions for program topics or titles that they would like to see offered, rather than the determination of actual performance.

Phase II, Investigation

Phase II, Investigation, systematically examines the performance, needs, and objectives of the training needs assessment process. Additionally, feedback into the system is introduced with the concept of environmental scanning.

The components of Phase II were developed by the panel of experts as follows.

Component II.1, Determine Optimal Performance. Dr. Cameron defined this component as "determine optimal performance." Mr. Aldridge wrote, "review alternative ways to perform tasks."

Component II.2, Identify Performance Differences. Mr. Aldridge identified three considerations in the makeup of this component. "Review skill levels of existing workers. Review existing skill levels to skills necessary for each alternative way to perform the tasks. Identify skill deficiencies and training or new hiring necessary to acquire the required skill level for each alternative."

Component II.3, Distinguish between "Training" and "Nontraining" Needs. Dr. Sork wrote that "the process should include a component in which the planners distinguish between 'training need' and 'non-training needs' for which training is at least part of the required intervention from those needs for which training will play no part." Dr. Sork also wrote that "the model should include an element related to resolving differences of opinion regarding present and desired capabilities--or differences of opinion about the

magnitude or even the existence of prescriptive and motivational needs."

Component II.4, Identify Objective of TNA. Mr. Aldridge wrote, "select method to accomplish tasks and identify training needed by workers to perform the tasks." Dr. Sork wrote:

> The model should include a component dealing with setting priorities--that is, a process for deciding which needs will be addressed, and in which order, from those that are identified. This assumes that there will never be enough resources to address all the needs that are identified.

Ms. Pogue wrote:

> Assess your technology transfer environment: Find out what information, technical assistance, publications, audiovisual materials, etc. are already being used by your target audience(s). The model should be adaptable to a wide range of training contexts--in other words, it should be a flexible model and offer the user multiple means of approaching the assessment task.

Component II.5, Initiate Environmental Scanning. Dr. Boone contributed this component and wrote: "Thoroughly research the issue/problem/opportunity to acquire as much information about and to become thoroughly knowledgeable

about the issue/problem/opportunity. (The assumption is that this will be accomplished by the training leader and environmental scanning committee.)"

Phase III, Implications

Phase III, Implications, sets the stage for evaluating the operational context of the model. The components of Phase III were developed by the panel of experts as follows.

Component III.1, Determine Alternative Solutions. Dr. Cameron expressed this component as "determination of alternative solutions."

Component III.2, Evaluate Existing Technology. Ms. Pogue was concerned with keeping "abreast of new training technologies: Keep informed about the latest training technologies so that they are a factor in making decisions about training formats." Mr. Aldridge expressed similar concerns and wrote, "Review levels of technology to accomplish tasks. Review availability of new technology." Dr. Sork wrote that "the model should include provision for the identification of both prescriptive (or what Houle defines as ascribed needs) and motivational (or what Houle defines as felt needs) needs."

Component III.3, Encourage Participation. Ms. Pogue expressed concern for the target audience. "Above all, listen and learn: Talk with your target audience. Get to know their problems and solutions. Ask them what they need and they want." Dr. Boone wrote:

> This processual [process and procedural] task is important in accessing (gaining entre [entry]) into the target public and stakeholder groups. The thoughts and feelings of the leaders/spokespersons (as well as the target public itself) would be elicited about the issue or need along with their views on how the issue or need can be resolved. These influentials (leaders) often hold the key to getting the target public to cooperate. This is an initial and beginning dialogue with the target public (i.e. job group). The goal is that of getting them involved in a planned exploration and discussion of the issue/problem/opportunity to identify with it and to become interested and motivated in becoming a party to its resolution.

Phase IV, Outcome

Phase IV, Outcome, is the section of the model that projects a result or consequence of the training needs assessment process. The components of Phase IV were developed by the panel of experts as follows.

Component IV.1, Evaluate Costs. Mr. Aldridge defined this component as "review costs of the alternatives."

Component IV.2, Summarize Information. Ms. Pogue was concerned with the clarity of the output of the training needs assessment process. "The model should make clear what the final 'product' should be of the needs assessment. That is, in unambiguous terms, it should specify what the outcome of the needs assessment will be." Dr. Boone wrote, "Surface and articulate needs. (These needs become the basis for designing a program that[,] if implemented, will fulfill the defined needs.)"

Phase V, Impact

Phase V, Impact, is the segment of the model that integrates the results, outlines the accomplishments, and evaluates the procedures. The components of Phase V were developed by the panel of experts as follows.

Component V.1, Develop Plan to Integrate Results of TNA. Dr. Boone wrote extensively on this component:

> The researcher should draw first upon the leaders[']/ spokepersons' know-how and then proceed to interject external . . . information (facts) as deemed appropriate into the study and analysis of the issue or need. During this process, relevant criteria such as

norms, benchmarks, work standards, etc. should be collaboratively identified. Inherent within the performance of this processual [process and procedural] task component are:

a. Data collection, analysis and interpretation. Numerous data collection methods exist, and the astute change agent (training and development officer) should be able to identify and select the most appropriate method for the respective issue/need. Some of these methods include surveys, interviews, observations, document studies, work sample examinations, task analysis, performance audits and appraisals, competency models, critical-incident processes, Delphi procedures (such as the one you are using in your study, Danal), nominal group techniques, assessment centers, quality circles, meetings, focus groups, learning contracts, and career objectives.

b. Identification, assessment and analysis of needs, based on the combined judgement of the target and stakeholders and their interpretation of the data.

As long as sound planning and patience are utilized, the actual collection, analysis, and interpretation of data should be fairly straight forward. However, it is important to remember that many discoveries can be made during data collection. If this happens, one should make good notes and follow

up later. The researcher should not get sidetracked on these new avenues; the change agent must remain focused.

Component V.2, Develop Action Plan Detailing What is to be Accomplished by TNA. Dr. Cameron perceived an outcome of this phase as a "strategic plan for implementing findings of needs assessment" and an "action plan detailing what is to be accomplished to meet needs."

Component V.3, Evaluate and Control. Ms. Pogue wrote, "Insure that training needs assessment is an on-going process: Make sure that your training needs assessment is constantly being updated by monitoring your target audiences." Dr. Sork added, "the model should include criteria for assessing the quality of needs assessment--that is, what standards should be applied to judge whether the needs assessment has been a 'good' one." Dr. Cameron called for an "evaluation plan (quality assurance) for the needs assessment."

Results of the Research Study Part II, Rating of Components by Practitioners

Once the final model (see Figure 8) was approved by the panel of experts, Part II of the research process began.

1. A letter was sent to the 51 technology transfer programs established by the FHWA to provide technical assistance and training to rural and small city transportation agencies. This letter included a form to be returned to the researcher designating an individual from each program to be responsible for the study (see Appendix J). Appendix K is a list of the FHWA-sponsored technology transfer programs.

2. A survey instrument was developed for the practitioners using the five phases and 18 components of the approved model (see Appendix L). Each component was rated in four dimensions--importance, amount of use, appropriateness, and willingness to use. The survey instrument was developed by the researcher with the assistance of the doctoral committee members supervising this study. (See Step 4 further information.)

3. The practitioner survey instrument was administered to two groups of selected individuals not connected to the study before they were distributed to the practitioner population. The first group was comprised of staff members of the Transportation Center at The University of Tennessee. The staff members chosen to review the draft

survey instrument did not work with any FHWA-sponsored technology transfer program and would not be responsible for responding to the final practitioner survey instrument. The researcher interviewed each participant after that participant had completed the survey instrument to solicit notes for needed corrections, suggestions for revisions, and other comments on and concerns about the survey instrument. The staff members made minor changes in wording (generally to make terminology consistent), corrected typographical and spelling errors, and noted minor problems in numbering. The staff members also made similar minor changes in the cover letter that was to be mailed with the survey instrument.

Two weeks later, the revised survey instrument (with cover letter) was administered to the second group of participants comprised of staff members of the Institute of Technology Management at The University of Tennessee. These participants were able to use the instruments without problems and provided no additional comments or suggestions for revision of the cover letter or survey instrument.

4. The researcher presented the final survey instrument (see Appendix L) for review to members of the doctoral committee supervising this study. Members of the committee supervising this study approved the survey instrument for implementation.

5. A cover letter (see Appendix M) along with the survey instrument was sent to the 51 FHWA-sponsored technology transfer programs in October 1993. Each training needs assessment component listed in the survey instrument was accompanied by a closed-end (Likert) scale from 1 to 7.

6. Demographic data were collected from the technology transfer program planners. This information included the technology transfer center planner's: (a) educational background, (b) academic preparation in needs assessment, and (c) experience in needs assessment.

Response Rate by the Practitioners

Of the survey instruments mailed to the 51 practitioners, 33 (or 65%) were returned in response to the initial mailing. Ten (or 20%) were returned as the result of a second or follow-up request. Three (or 6%) were returned after a third and final mailing. The total response was 46, or roughly 90%. There were five (or 10%) nonrespondents.

Data from 36 of the 46 practitioners were used in the study. Ten of the 46 survey instruments either were left blank or the same number was marked on every item. Ten of the practitioners sent letters expressing their feelings along with their complete (and usable) or incomplete questionnaires. These comments are incorporated in Appendix N.

Component Statistics, Practitioners

Table 1 shows the relative importance of the training needs assessment components to technology transfer program operations as perceived by the practitioners. Table 1 also shows the practitioners' evaluations of the amount of use of each component in the planning procedures of the technology transfer programs, the appropriateness of the component, and the technology transfer programs' willingness to use the component.

Figures 10-27 provide a graphic presentation of the mean scores for the variables importance, amount of use, appropriateness, and willingness to use for each of the 18 components, as rated by practitioners. This graphic presentation is provided to show visually the differences in the ratings of the 18 components.

Figures 28-31 present line graphs showing the mean scores for the variables of importance, amount of use, appropriateness, and willingness to use for each of the 18 components, as rated by the practitioners. Figure 32 presents a composite of the ratings of the four variables. The similarities of the ratings for each of the variables is discussed in Chapter V.

Table 1

Component Statistics for Practitioners

Component		Variable	Mean
I.1	Define "Need"	Importance	5.1
		Amount of Use	4.7
		Appropriateness	4.8
		Willingness to Use	5.2
I.2	Determine the Setting for TNA	Importance	4.1
		Amount of Use	4.1
		Appropriateness	3.9
		Willingness to Use	4.5
I.3	Identify Initiators of Need	Importance	5.0
		Amount of Use	4.6
		Appropriateness	4.7
		Willingness to Use	4.9
I.4	Identify Target Audience	Importance	6.0
		Amount of Use	5.6
		Appropriateness	5.7
		Willingness to Use	6.0
I.5	Evaluate Existing Performance Levels	Importance	4.6
		Amount of Use	3.9
		Appropriateness	4.3
		Willingness to Use	4.6
II.1	Determine Optimal Performance	Importance	4.4
		Amount of Use	3.7
		Appropriateness	3.9
		Willingness to Use	4.2
II.2	Identify Performance Differences	Importance	4.0
		Amount of Use	3.5
		Appropriateness	3.6
		Willingness to Use	3.8
II.3	Distinguish between "Training" and "Nontraining" Needs	Importance	4.5
		Amount of Use	4.3
		Appropriateness	4.5
		Willingness to Use	4.6
II.4	Identify Objective of TNA	Importance	4.6
		Amount of Use	4.4
		Appropriateness	4.5
		Willingness to Use	4.7
II.5	Initiate Environmental Scanning	Importance	3.8
		Amount of Use	3.7
		Appropriateness	3.9
		Willingness to Use	4.0

Table 1 (continued)

Component		Variable	Mean
III.1	Determine Alternative Solutions	Importance	4.9
		Amount of Use	4.6
		Appropriateness	4.7
		Willingness to Use	4.9
III.2	Evaluate Existing Technology	Importance	5.2
		Amount of Use	4.7
		Appropriateness	5.1
		Willingness to Use	5.3
III.3	Encourage Participation	Importance	5.8
		Amount of Use	5.6
		Appropriateness	5.7
		Willingness to Use	5.7
IV.1	Evaluate Costs	Importance	4.9
		Amount of Use	4.7
		Appropriateness	4.5
		Willingness to Use	4.9
IV.2	Summarize Information	Importance	5.1
		Amount of Use	5.1
		Appropriateness	5.1
		Willingness to Use	5.3
V.1	Develop Plan to Integrate Results of TNA	Importance	4.8
		Amount of Use	4.7
		Appropriateness	4.8
		Willingness to Use	5.1
V.2	Develop Action Plan Detailing What is to be Accomplished by TNA	Importance	4.7
		Amount of Use	4.5
		Appropriateness	4.7
		Willingness to Use	5.0
V.3	Evaluate and Control	Importance	4.6
		Amount of Use	4.3
		Appropriateness	4.5
		Willingness to Use	4.7

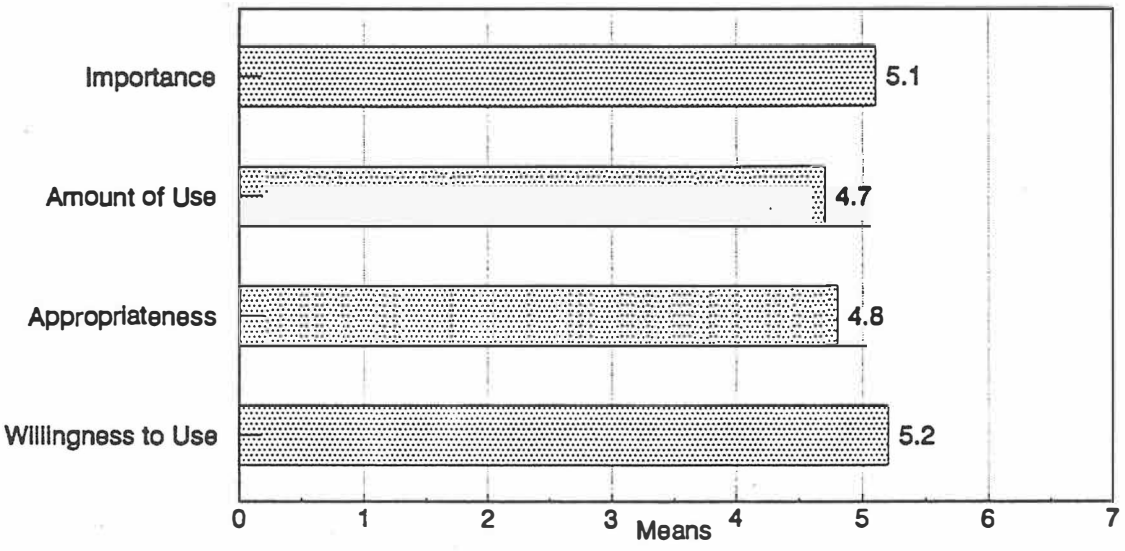


Figure 10. Mean Ratings for Component I.1, Define "Need".

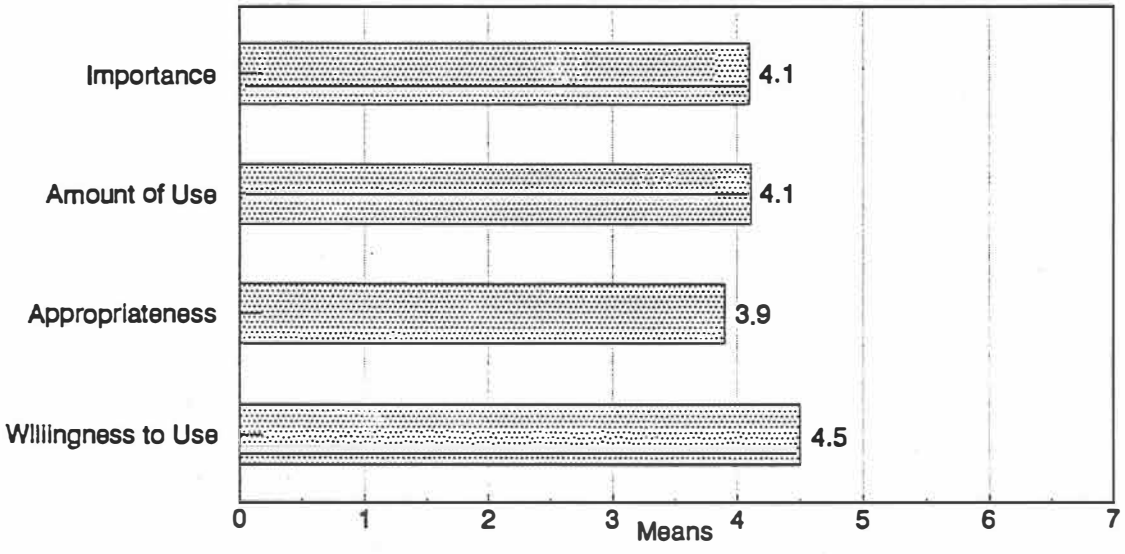


Figure 11. Mean Ratings for Component I.2, Determine the Setting for TNA.

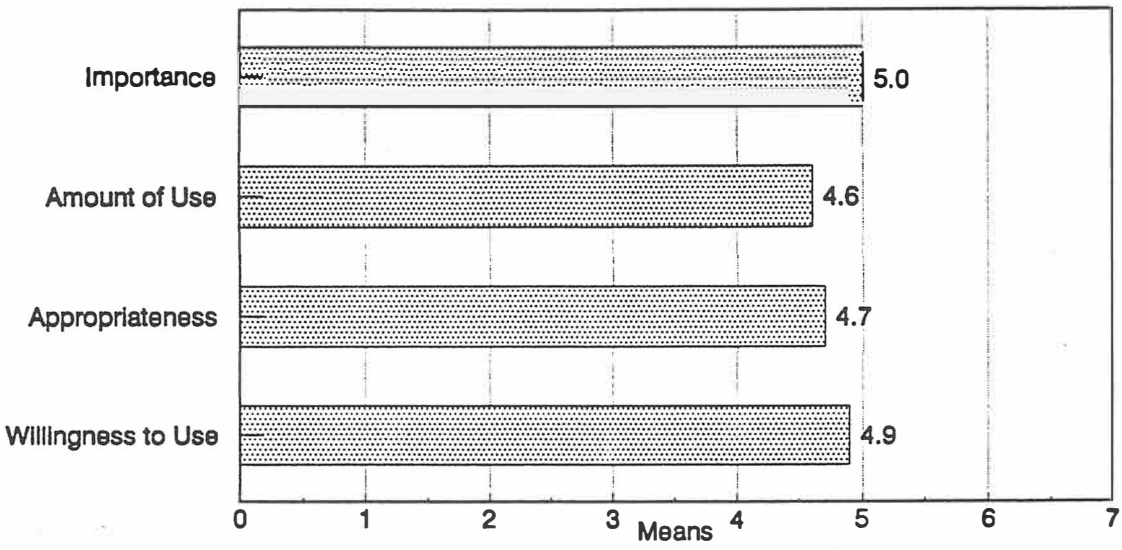


Figure 12. Mean Ratings for Component I.3, Identify Initiators of Need.

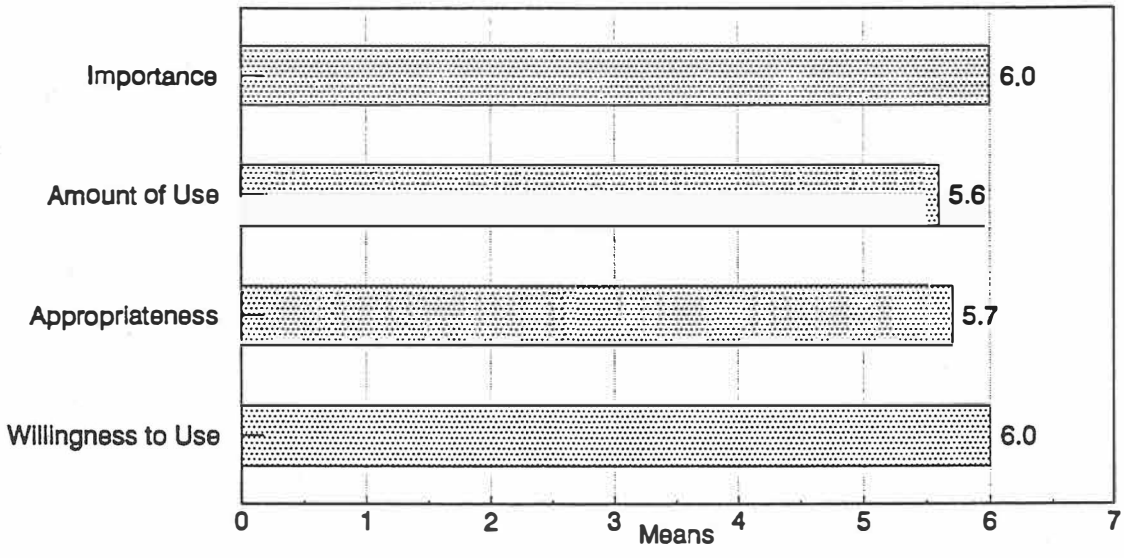


Figure 13. Mean Ratings for Component I.4, Identify Target Audience.

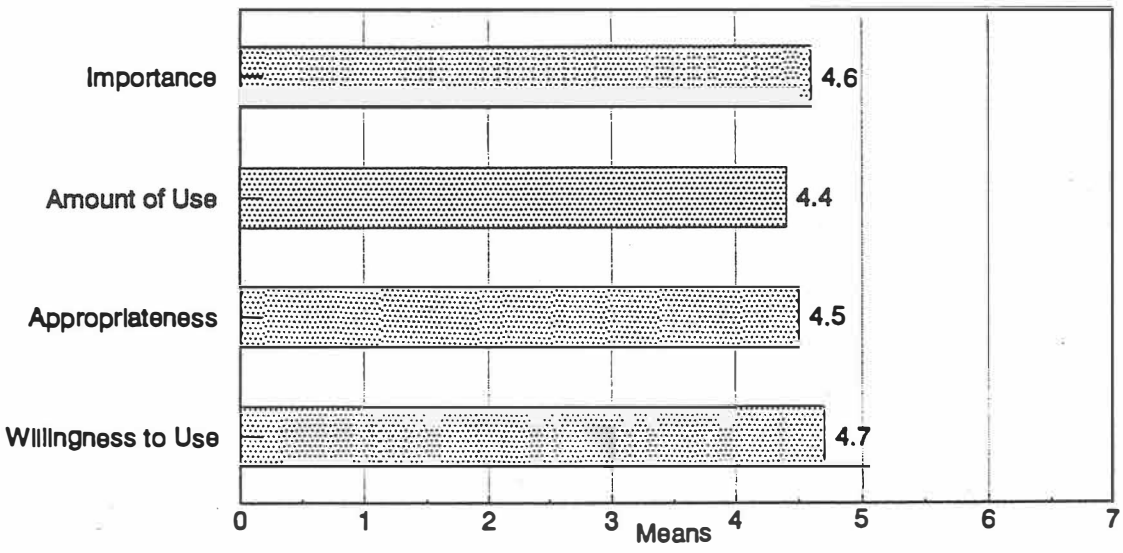


Figure 14. Mean Ratings for Component I.5, Evaluate Existing Performance Levels.

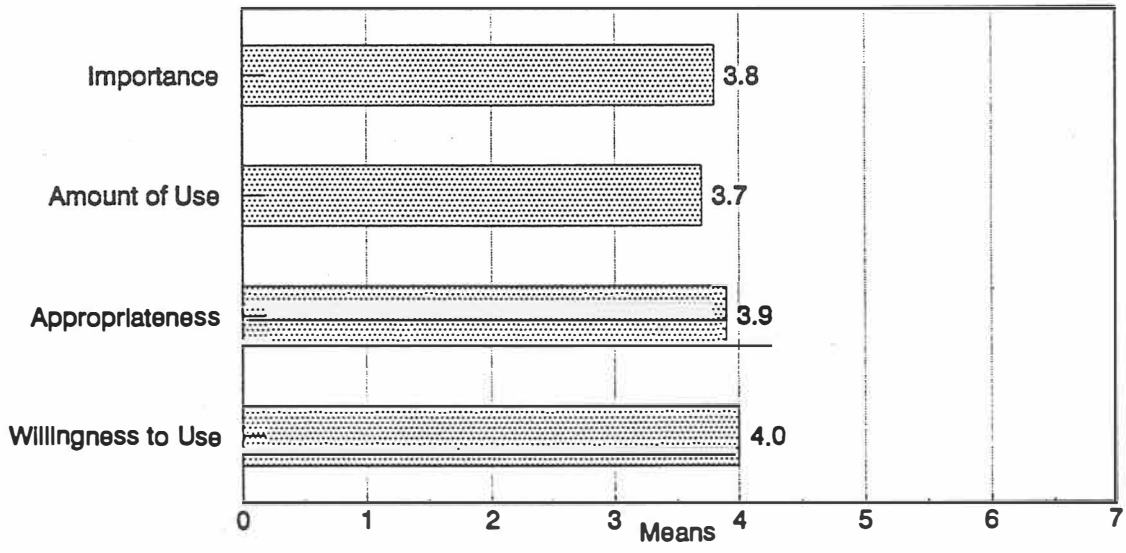


Figure 15. Mean Ratings for Component II.1, Determine Optimal Performance

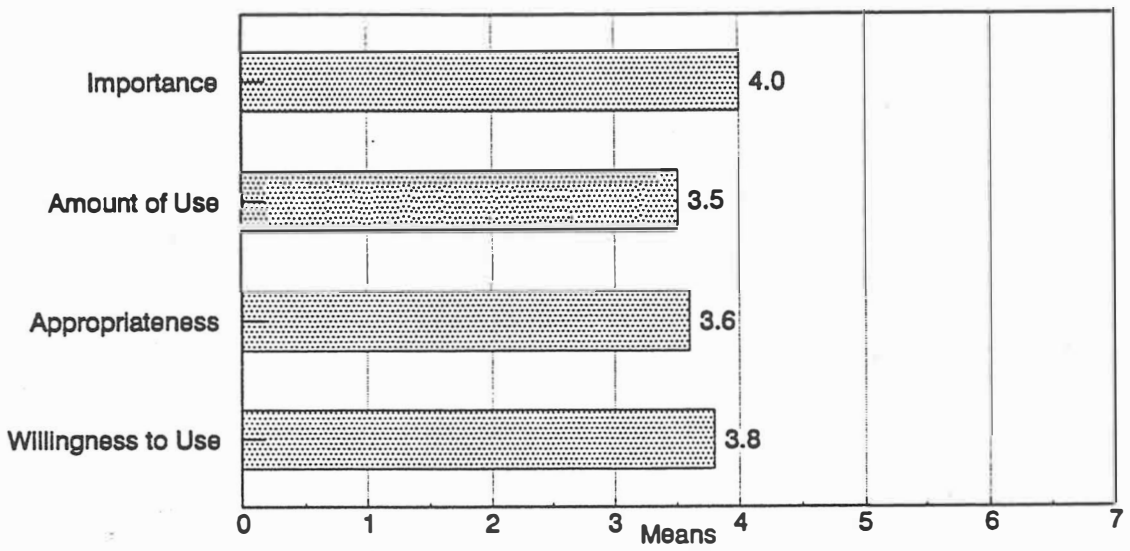


Figure 16. Mean Ratings for Component II.2, Identify Performance Differences.

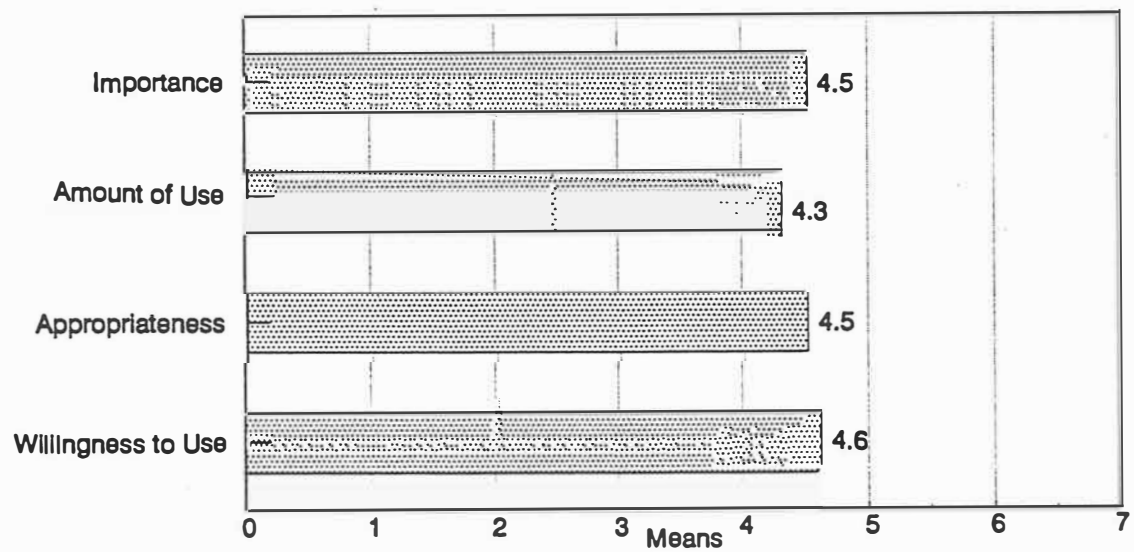


Figure 17. Mean Ratings for Component II.3, Distinguish Between "Training" and "Nontraining" Needs.

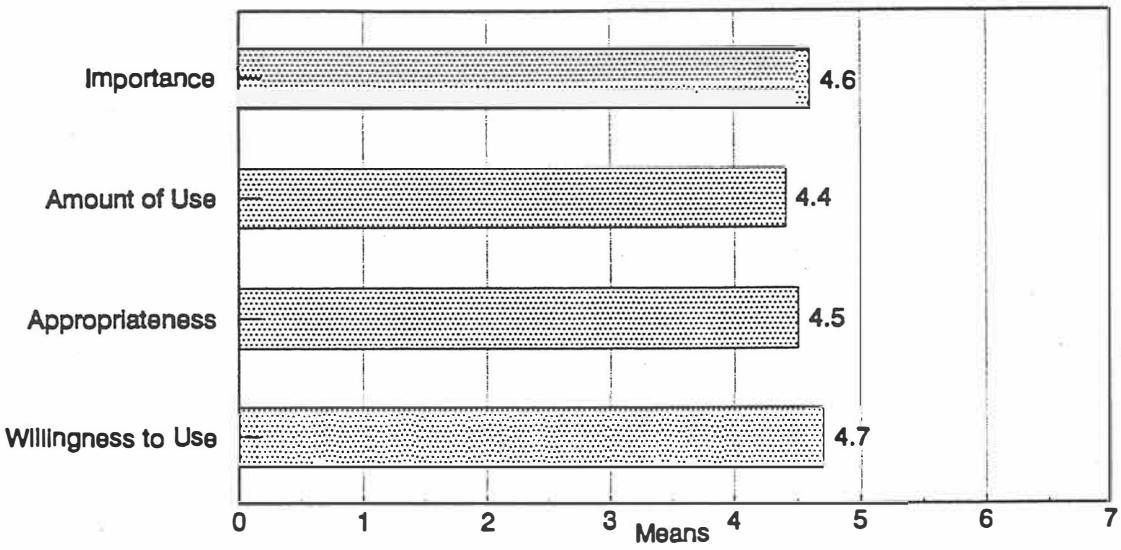


Figure 18. Mean Ratings for Component II.4, Identify Objective of TNA.

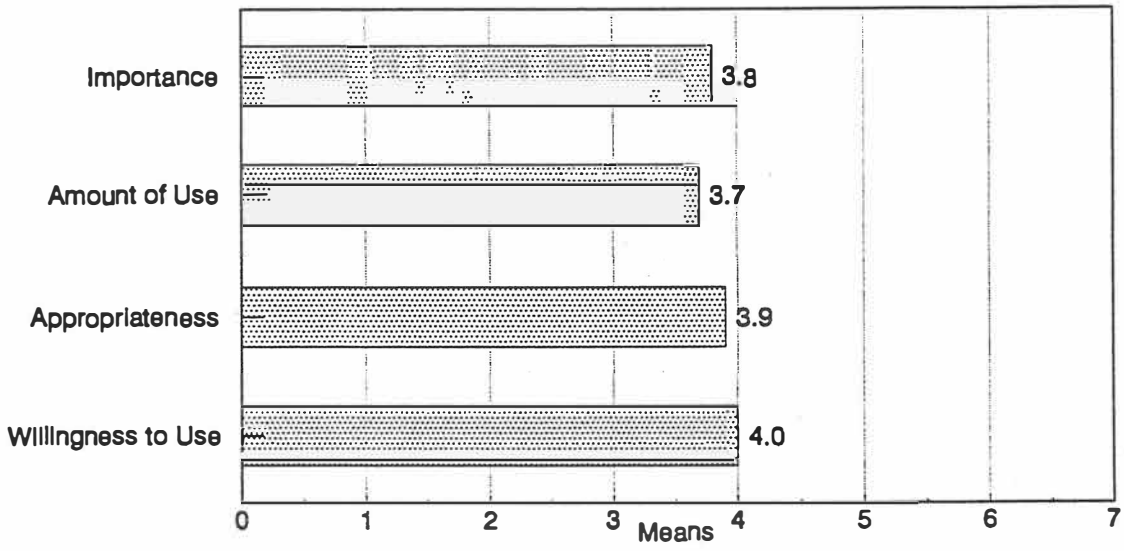


Figure 19. Mean Ratings for Component II.5, Initiate Environmental Scanning.

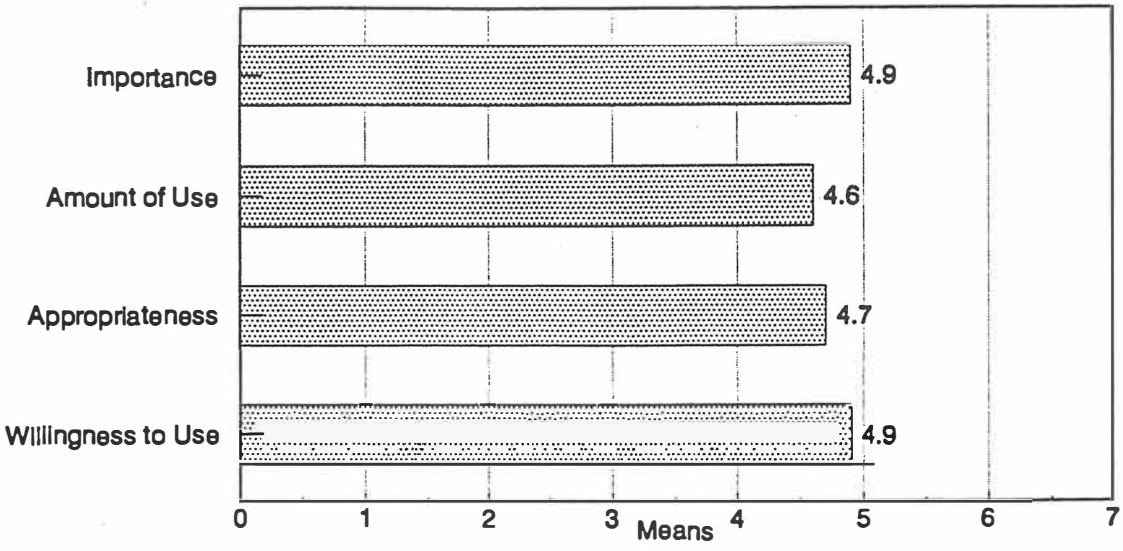


Figure 20. Mean Ratings for Component III.1, Determine Alternative Solutions.

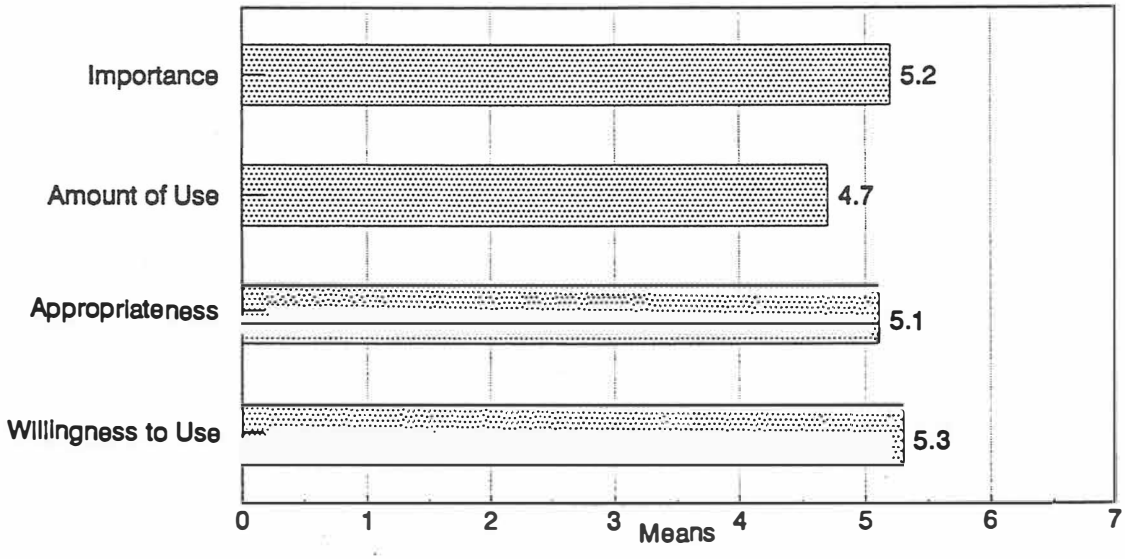


Figure 21. Mean Ratings for Component III.2, Evaluate Existing Technology.

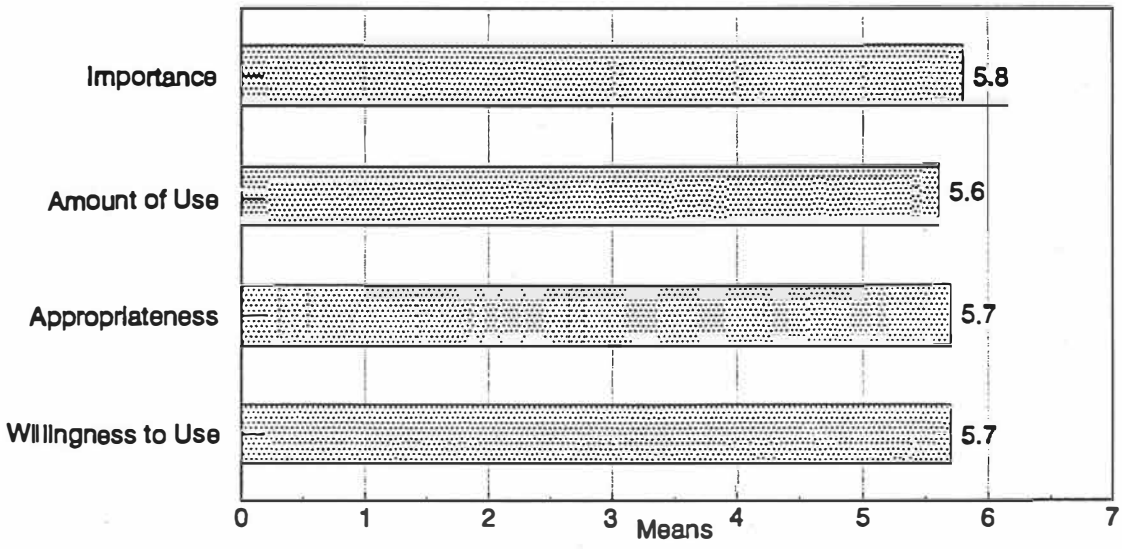


Figure 22. Mean Ratings for Component III.3, Encourage Participation.

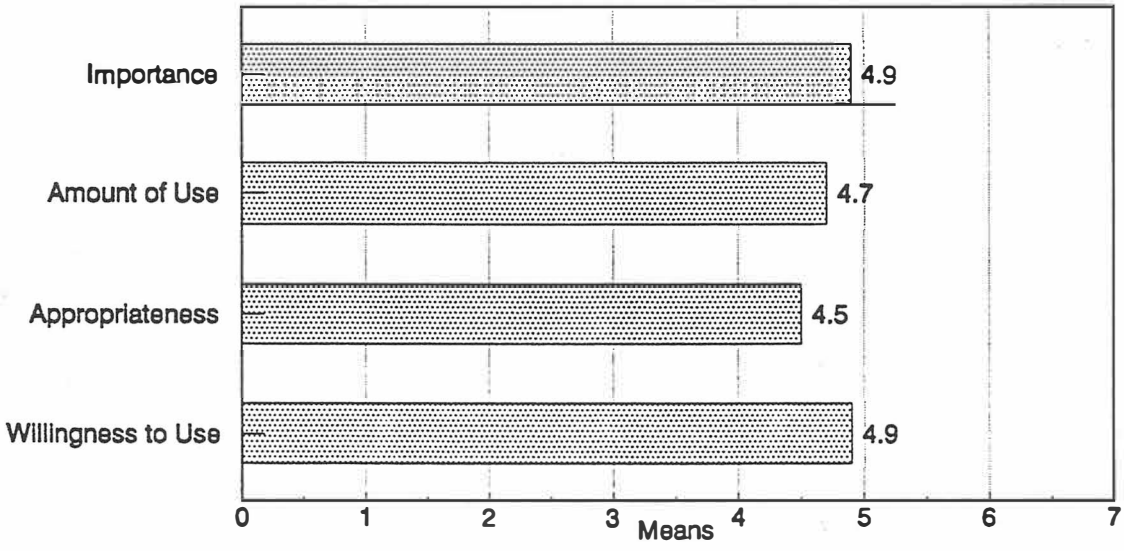


Figure 23. Mean Ratings for Component IV.1, Evaluate Costs.

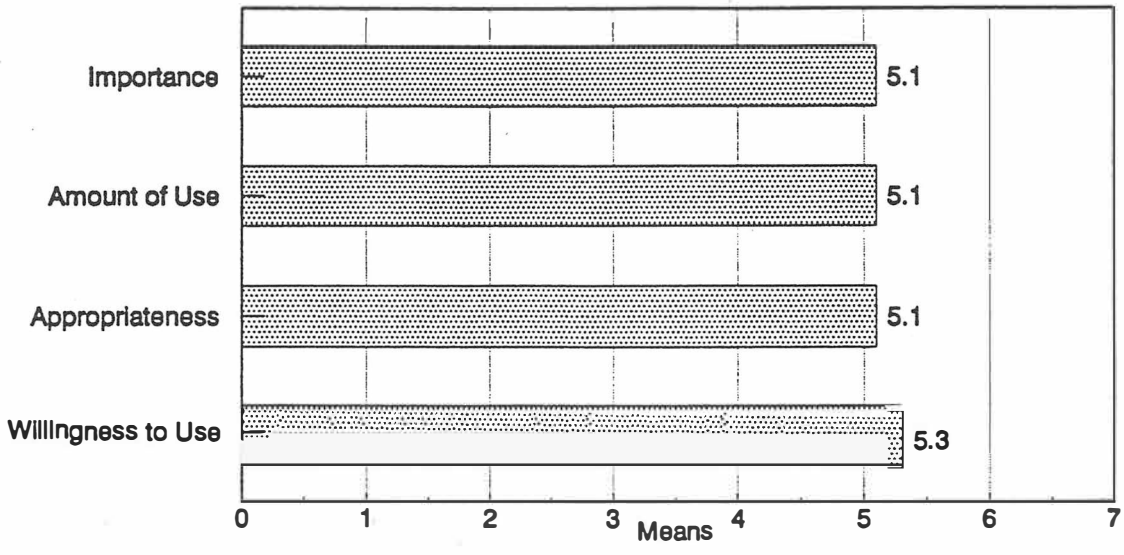


Figure 24. Mean Ratings for Component IV.2, Summarize Information.

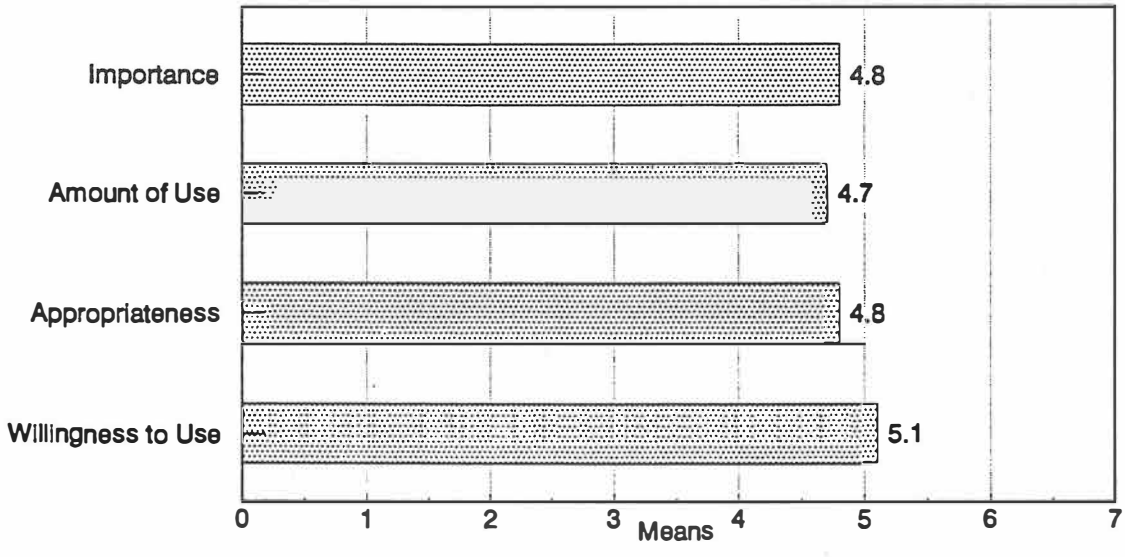


Figure 25. Mean Ratings for Component V.1, Develop Plan to Integrate Results of TNA.

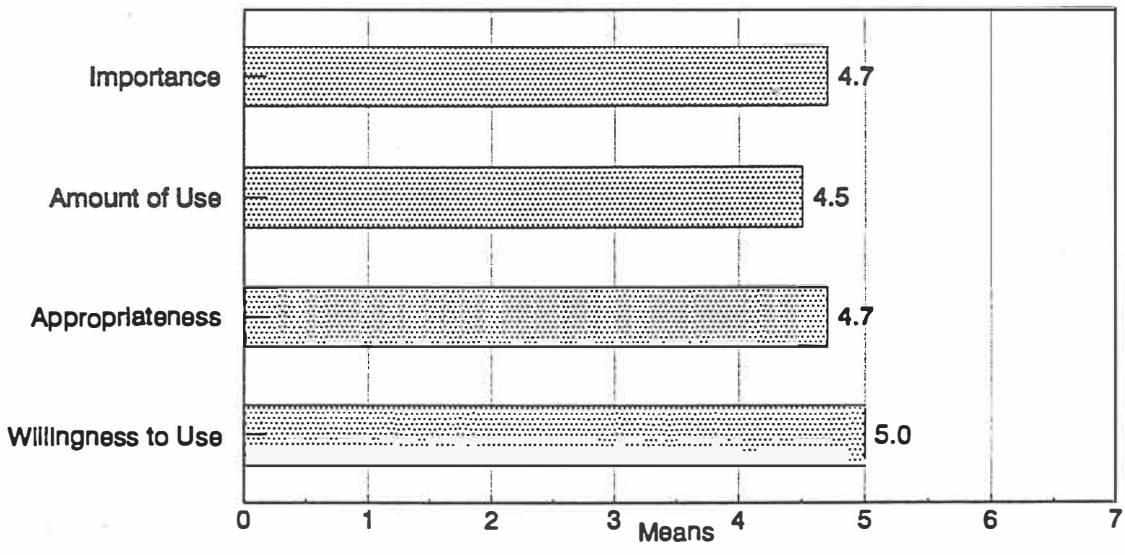


Figure 26. Mean Ratings for Component V.2, Develop Action Plan Detailing What is to be Accomplished by TNA

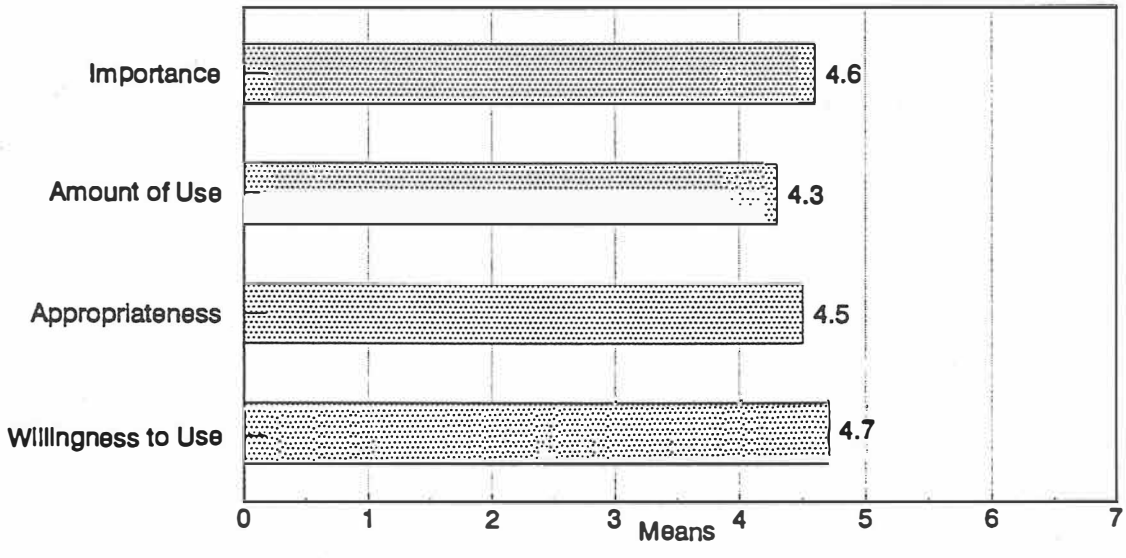


Figure 27. Mean Ratings for Component V.3, Evaluate and Control.

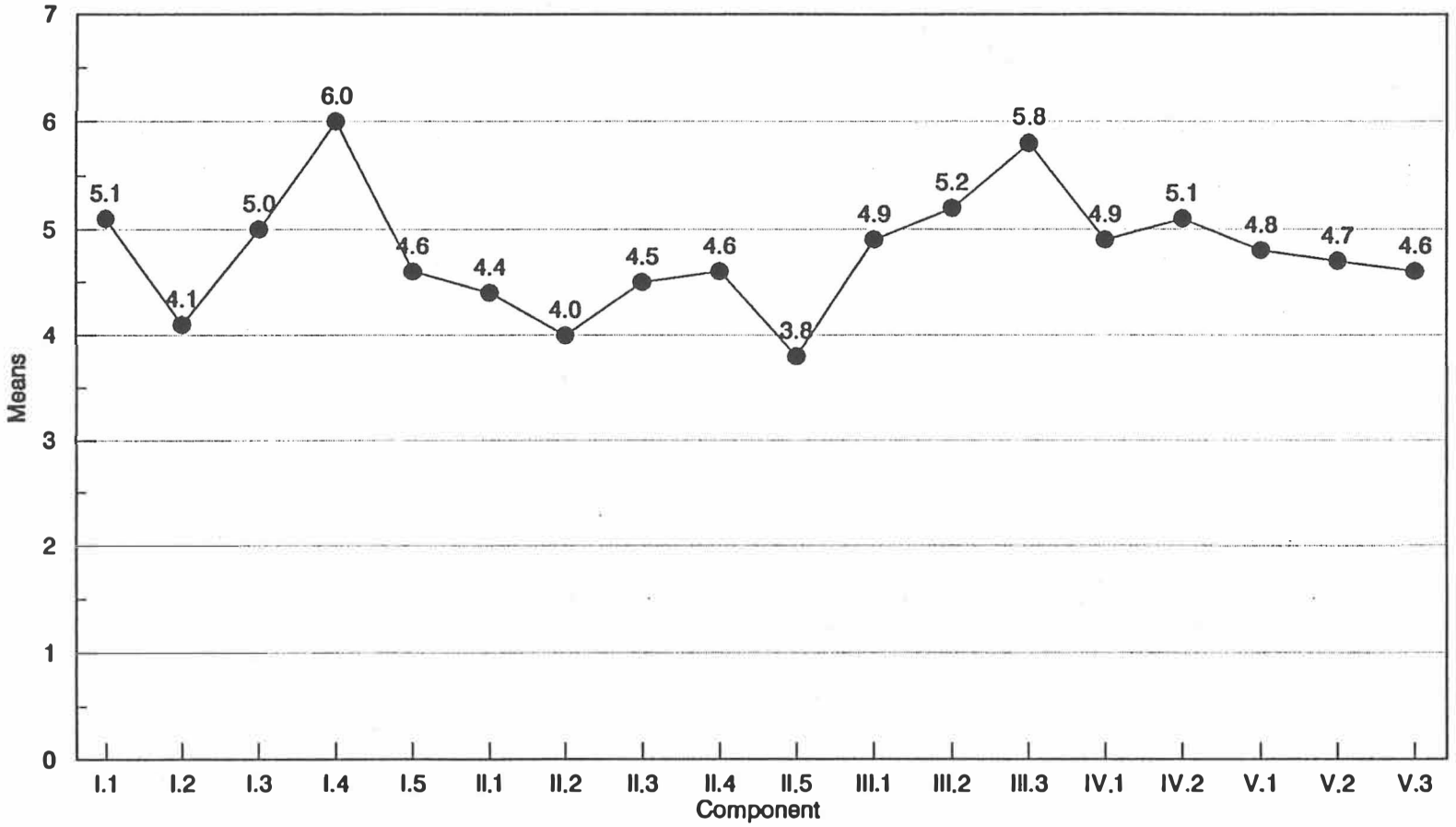


Figure 28. Practitioner Mean Ratings for Importance of Components.

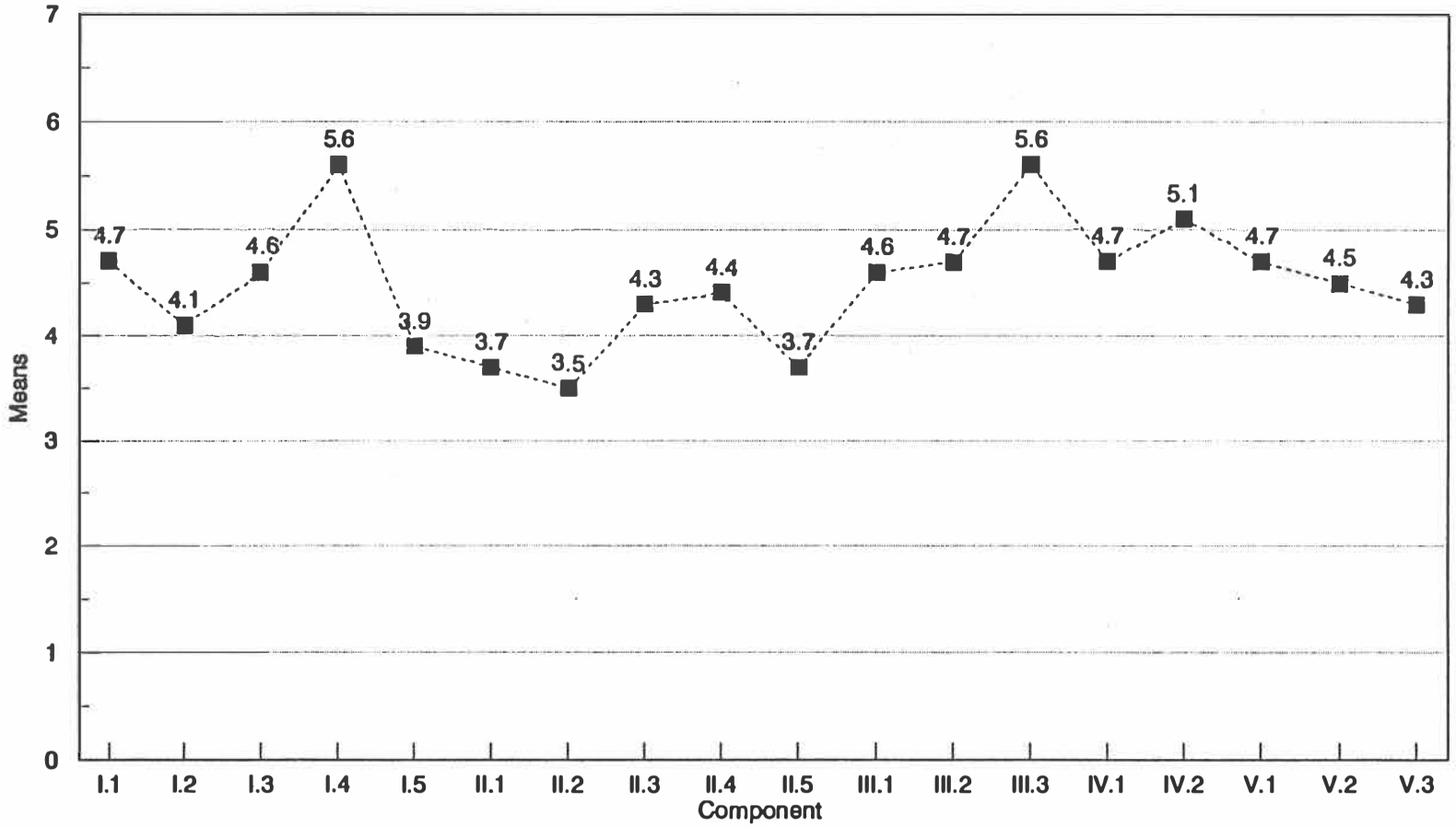


Figure 29. Practitioner Mean Ratings for Amount of Use of Components.

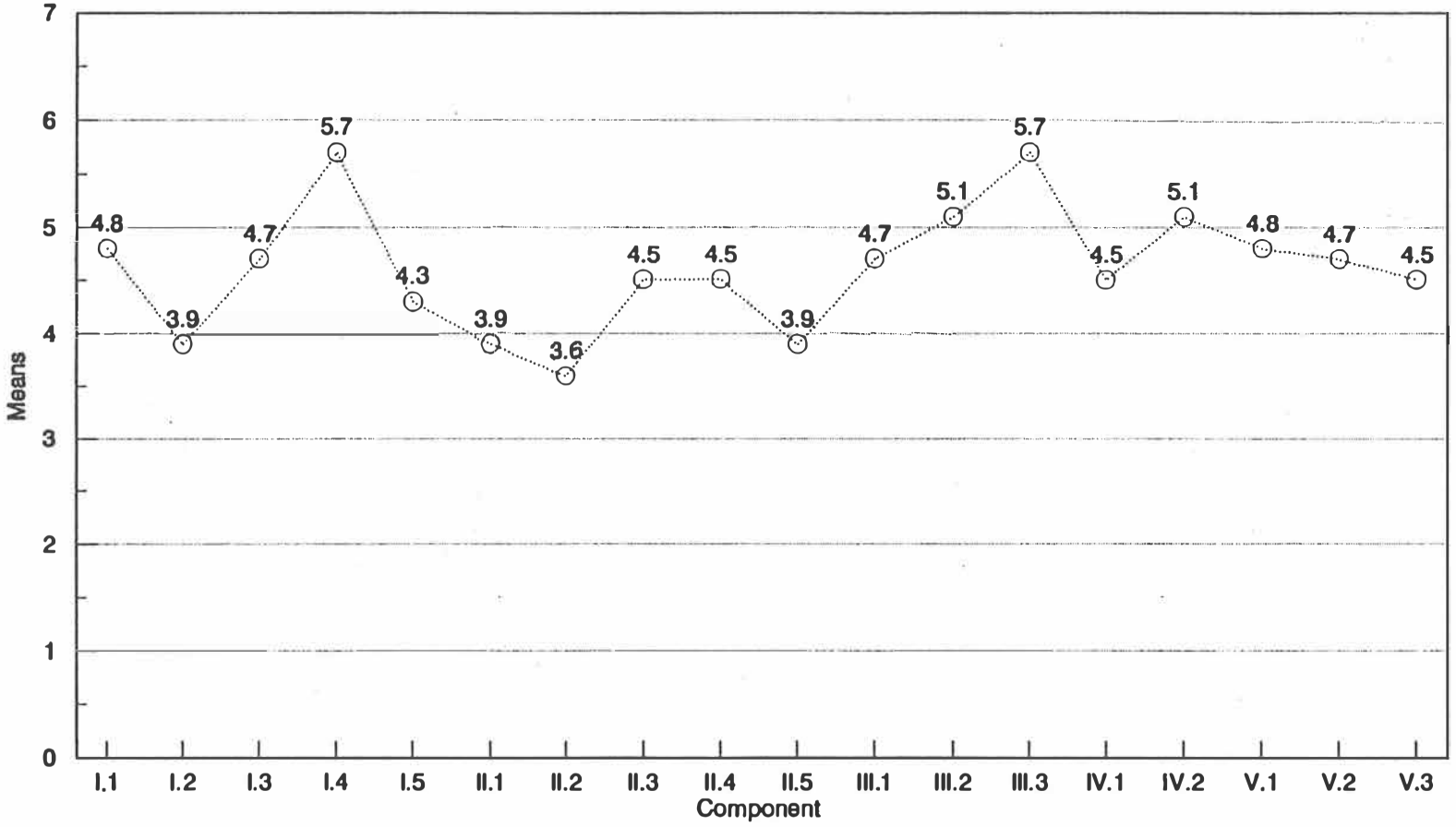


Figure 30. Practitioner Mean Ratings for Appropriateness of Components.

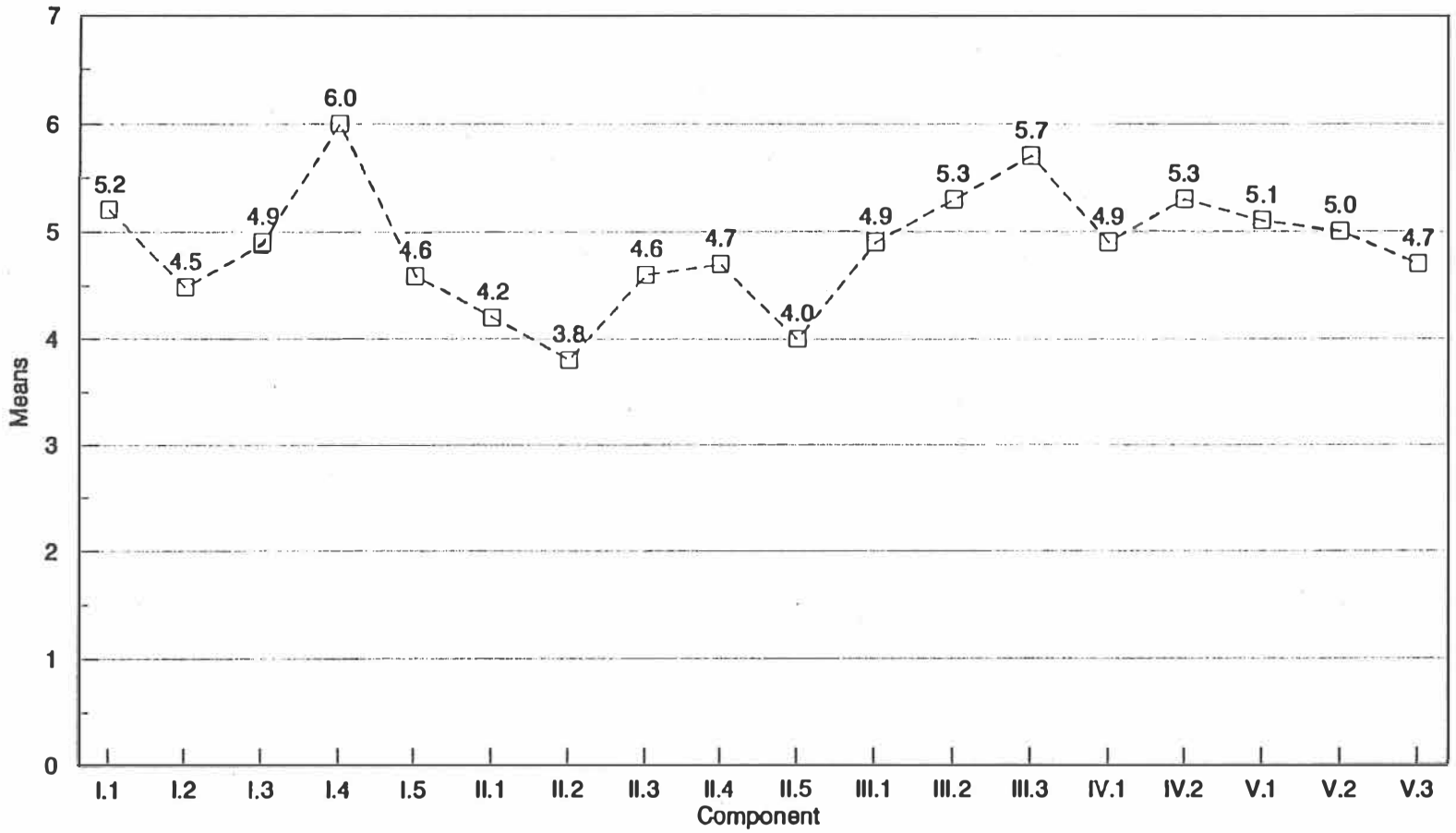


Figure 31. Practitioner Mean Ratings for Willingness to Use Components.

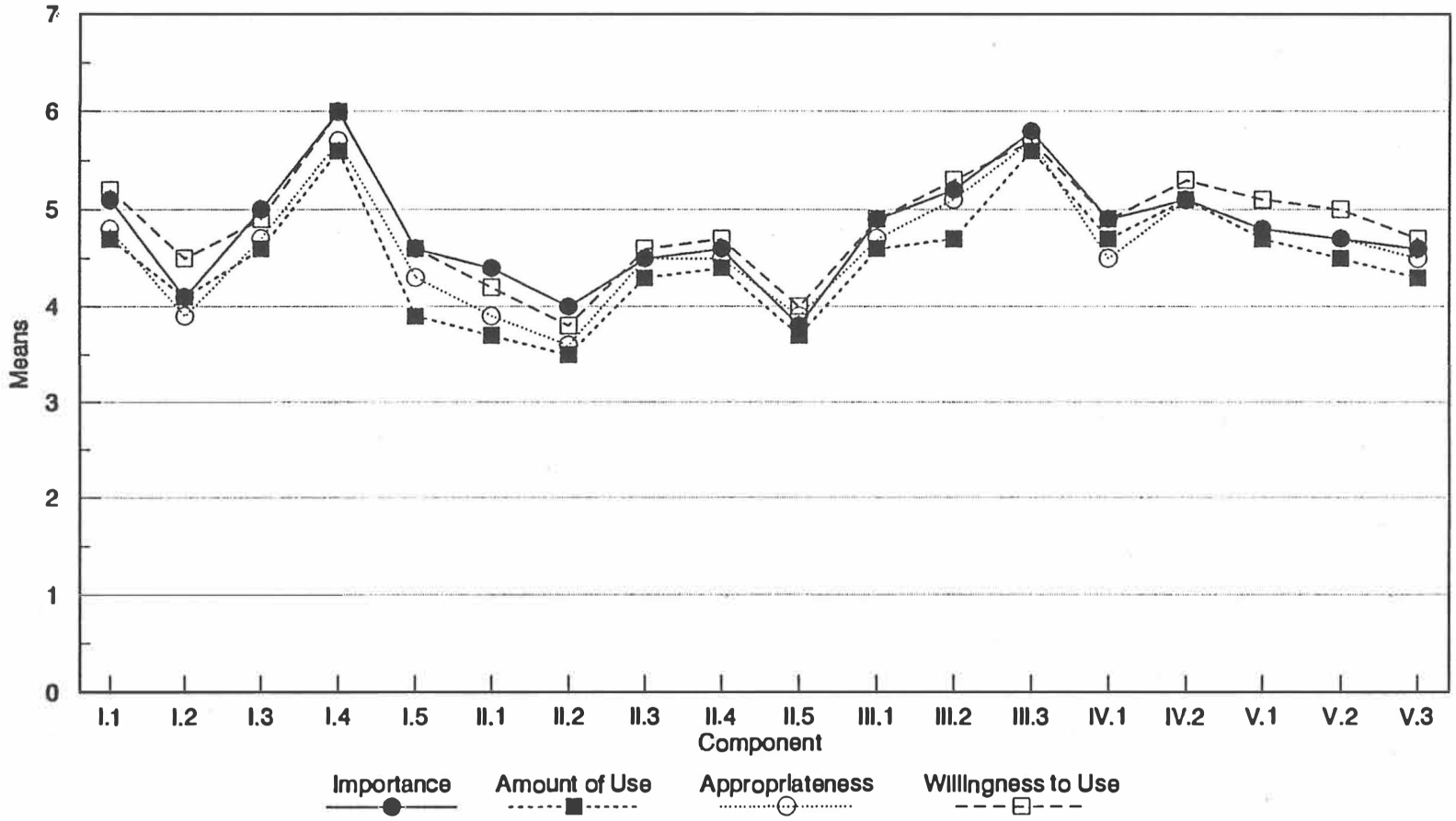


Figure 32. Composite of Practitioner Mean Ratings of Components.

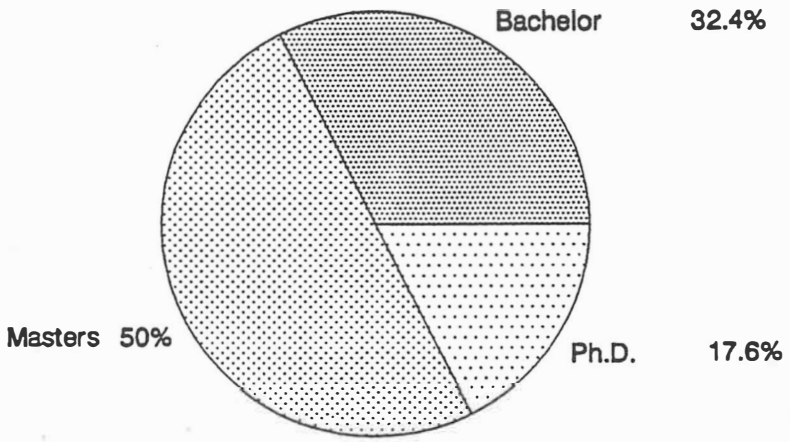
Demographics

Table 2 indicates the background demographics of the technology transfer program planners (practitioners), including terminal degree, major field of study, formal training in conducting needs assessment, the number of courses taken in the field, experience in conducting a training needs assessment in technology transfer programs, and the number of needs assessments conducted. The demographic information was collected to assist in describing the practitioner population and to make inferences concerning the needs assessment process. Figures 33-35 are pie charts showing distribution of the demographics revealed in the study.

Table 2

Technology Transfer Center Practitioner Demographics

Characteristic	Number	Percent
Terminal Degree (n=36)		
Bachelor	11	30.6
Masters	17	47.2
Ph.D.	6	16.7
No Response	2	5.6
Major Field of Study (n=36)		
Engineering	21	58.3
Education	5	13.9
Social Science	4	11.1
Business	4	11.1
No response	2	5.6
Received any Formal Instruction in Conducting a Training Needs Assessment (n=36)		
Yes	11	30.6
No	24	66.7
No Response	1	2.8
Number of Courses in the Field (n=36)		
One	3	8.3
Two	4	11.1
Three	3	8.3
Four	1	2.8
None ("No" to previous question)	24	66.7
No Response (to previous question)	1	2.8
Conducted a Training Needs Assessment at T^2 Center (n=36)		
Yes	27	75.0
No	8	22.2
No Response	1	2.8
Number of Needs Assessments Conducted (n=36)		
1-5	23	63.9
6-10	3	8.3
16-20	1	2.8
Over 20	0	0.0
None ("No" to previous question)	8	22.2
No Response (to previous question)	1	2.8



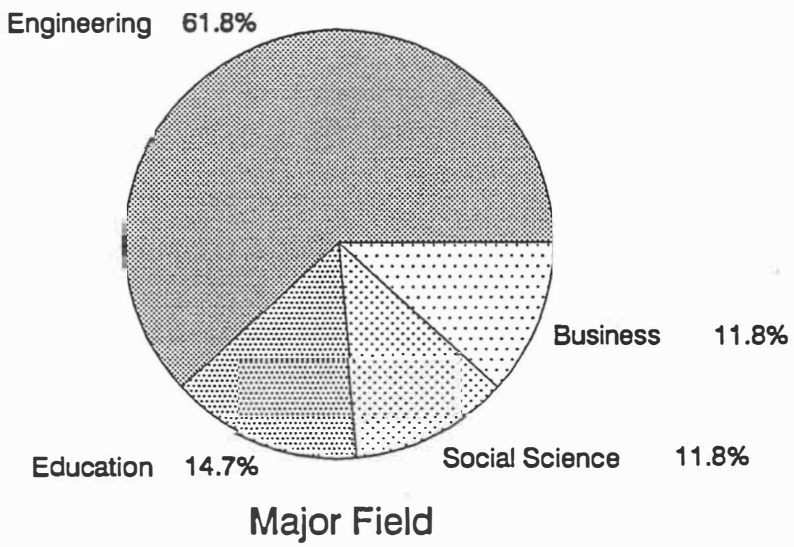
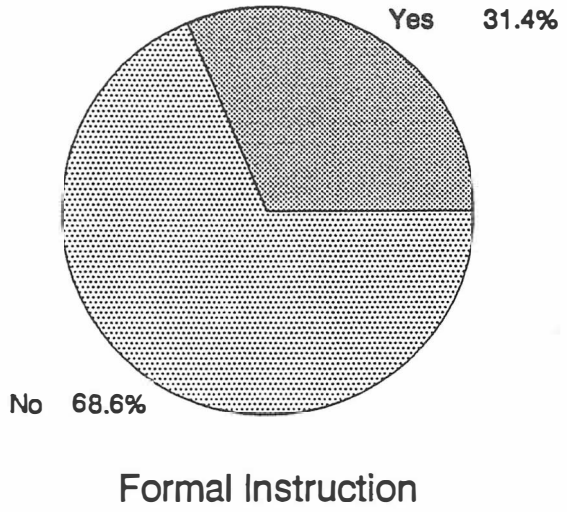


Figure 33. Demographics--Terminal Degree and Major Field.



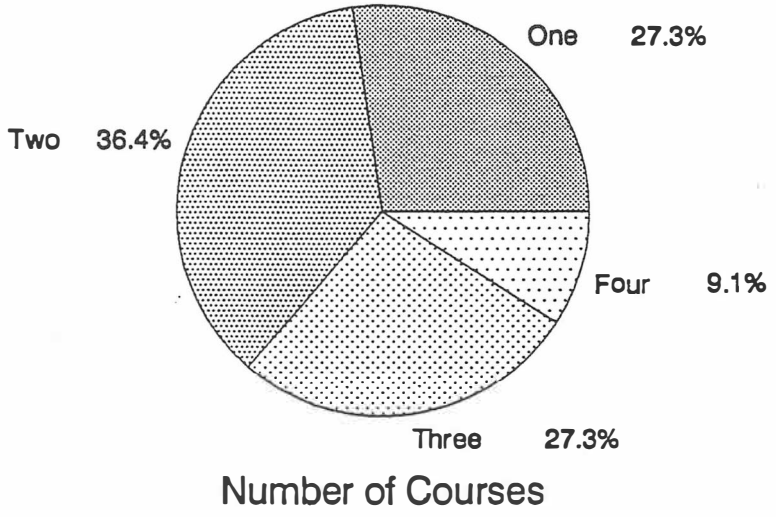
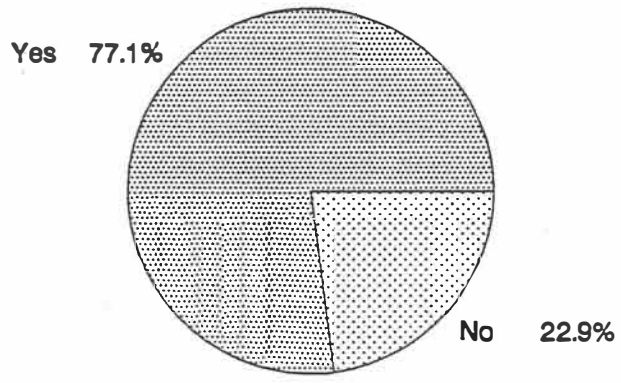
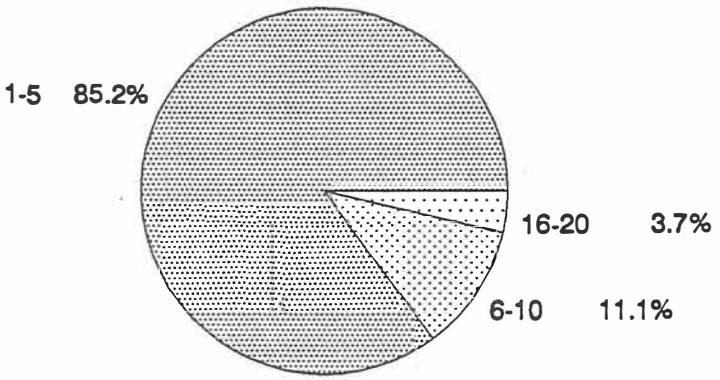


Figure 34. Demographics--Formal Instruction in Training Needs Assessment and Number of Courses Taken.



Conducted a Training Needs Assessment?



Number Conducted

Figure 35. Demographics--Experience in Conducting Training Needs Assessment and Number Conducted.

Chapter V

Summary, Findings, Conclusions, Recommendations, Problems for Further Study, and Discussion

Preceding chapters of this dissertation presented the problem to be studied (Chapter I), a review of the literature pertinent to the study (Chapter II), the procedures used in the study (Chapter III), and an analysis and findings of the study (Chapter IV). This chapter summarizes the study, discusses the findings, states conclusions concerning the findings, recommends potential solutions for the problem, and proposes problems for further study.

Summary

This study was undertaken to facilitate the process of training needs assessment in the environment of technology transfer. A review of the literature pertinent to this study revealed that, although much has been published on the subject of needs assessment, only limited work was done on a model to assist in the training needs assessment environment for technology transfer.

Summary of the Research Study Part I, the Delphi Study

The Delphi procedure was used to delineate the components of a training needs assessment model. The Delphi

procedure produced a model for potential implementation for training needs assessment for technology transfer programs.

The Delphi study and procedures were not without problems and flaws. Olaf Helmer, one of the codevelopers of the Delphi process for the original Air Force-sponsored Rand Corporation study presented in July 1962, wrote that "Delphi still lacks a completely sound theoretical basis. This is due, largely, to the fact that Delphi, by definition, is concerned with the utilization of experts' opinions and that experts are rarely available as experimental laboratory subjects" (Helmer 1967, p. xix). The use of the Delphi process in this study conformed to one of the ten application areas outlined by Linstone and Turoff (1975). The authors emphasize that the Delphi process is adaptable to "putting together the structure of a model" (p. 4).

The Delphi process as used in this study worked well in its initial phase of identifying the components for training needs assessment. However, the procedures became burdensome as the study progressed through the third round. Consensus on the structure of the model was more difficult to achieve after the original components were identified, classified, and categorized. Nevertheless, the panel of experts reached consensus on the structure developed by the researcher.

Summary of the Research Study Part II, Rating of Components by Practitioners

The practitioners rated the variables relating to importance, the amount of use of the components in the planning procedures of the technology transfer program, the appropriateness of the components, and the technology transfer program practitioner's willingness to use the components. Figures 10-31 (pp. 118-130) and Table 1 (pp. 116-117) show the individual means for these variables.

In rating the amount of use of the components, practitioners rated 14 of the 18 components from moderate to high amount of use. The practitioners rated the components Evaluate Existing Performance Levels (I.5), Determine Optimal Performance (II.1), Identify Performance Differences (II.2), and Initiate Environmental Scanning (II.5) between low-moderate and moderate.

In rating the appropriateness of the components, practitioners rated 14 of the 18 components from moderate to high appropriateness. Practitioners rated the other four components--Determine the Setting for TNA (I.2), Determine Optimal Performance (II.1), Identify Performance Differences (II.2), and Initiate Environmental Scanning (II.5)--between low-moderate and moderate.

In rating willingness to use the components, practitioners rated 17 of the 18 components from moderate

to high willingness. Practitioners rated the component Identify Performance Differences (II.2) between low-moderate and moderate.

The meanings of these ratings are discussed as part of Step 6 under the heading Research Study Part II, Rating of Components by practitioners (p. 42-43).

Findings

This section presents the major findings from this study. A critical review of the Delphi model-building process is followed by an analysis of the data from the rating phase of the study.

Findings of Part I, the Delphi Study

1. The Delphi process was invaluable in initiating and categorizing the components of the Training Needs Assessment for Technology Transfer Model.

2. Using the Delphi process for model-building requires administration and direction from the researcher.

3. The Delphi process is time-consuming for members of the panel of experts. The researcher needs to continue encouragement and "cheerleading" to receive results.

4. When using the Delphi process to build models, the number of rounds can become overly extensive due to the need to summarize and present the expert responses.

5. The final approval of the research requires consensus. Consensus, even when the experts are not dealing

face to face, is a demanding process of ensuring that each of the experts is content with the model.

6. A model built using a panel of experts and the Delphi process can potentially alienate practitioners. Practitioners may resent using a model designed by others. This situation is inherent to the implementation of any process and is generally dealt with by requiring more participation from the practitioners. Dr. Boone reinforces this concept in his comments in Figure 2, Tentative Heading 11, Encourage Participation.

Findings of Part II, Rating of Components by Practitioners

The findings in Part II of the study indicate the reactions of the practitioners to the components identified by the experts.

Findings of the Practitioners

1. The component rated lowest in importance by the practitioners was Initiate Environmental Scanning (II.5). Inferences concerning this finding are stated in the Conclusions section of this chapter.

2. The components rated lowest in amount of use by the practitioners were Evaluate Existing Performance Levels (I.5), Determine Optimal Performance (II.1), Identify Performance Differences (II.2), and Initiate Environmental

Scanning (II.5). Inferences concerning these findings are stated in the Conclusions section of this chapter.

3. The components rated lowest in appropriateness by the practitioners were Determine the Setting for TNA (I.2), Determine Optimal Performance (II.1), Identify Performance Differences (II.2), and Initiate Environmental Scanning (II.5). Inferences concerning these findings are stated in the Conclusions section of this chapter.

4. The component rated lowest by the practitioners for willingness to use the component in a technology transfer program were Identify Performance Differences (II.2). Inferences concerning these findings are stated in the Conclusions section of this chapter.

5. Ten of the practitioners sent letters expressing their feelings along with their complete or incomplete questionnaires. The dissatisfaction of some of the practitioners concerning the model needs to be noted. Their comments are included in Appendix N. It can be inferred from the number of letters sent and the comments made by the practitioners that two conditions may be prevalent.

The first condition may be that the practitioners felt "dictated to" by the panel of experts and the researcher. The second condition may be that the practitioners were not allowed to participate in the model-building phase of the study. This second condition infers that one of the components identified by the experts, Encourage

Participation (III.3), is important to the model-building phase of Delphi also.

Conclusions

With respect to the limitations and scope of this study and the extent to which the data and findings were valid, the following conclusions have been drawn from the findings.

Conclusions Related to Part I, the Delphi Study

1. The Delphi process is a useful method for gathering qualitative information in the training needs assessment model-building process. Academic experts, subject matter experts, or practitioners are excellent sources for preliminary inputs into a Delphi model-building exercise.

2. Even though the literature identified model-building as an appropriate use, the Delphi process was found to be inefficient in structuring a model due to the multiple expert-researcher loops. It is difficult to quantify the structure of a model using remotely located experts. Even though the experts may agree on the components, assembling the components into a model is a difficult process to manage.

3. There should be a structured rating procedure in place to ensure that the model is in some way quantified. Even though the Delphi process may lead to consensus, the

model should have some system of measurement in place to add validity to the rating and procedures.

Conclusions Related to Part II, Rating of the Components

1. The ratings for amount of use reveal that practitioners are currently using 14 of the 18 components in the training needs assessment procedures in their technology transfer programs. However, four of the components-- (I.5) Determine Optimal Performance (II.1), Identify Performance Differences (II.2), and Initiate Environmental Scanning (II.5)--were rated low-moderate. It is important to recognize that the literature reviewed on this subject emphasizes that determining optimal performance and existing performance levels as well as identifying performance differences are vital to the training needs assessment process. The concept of environmental scanning may have been rated moderate by practitioners due to the fact that environmental scanning is a "buzz word" brought into the Training Needs Assessment for Technology Transfer Model. It relates to the concept of feedback and revision in the ISD Model. Environmental scanning permeates the model more than a feedback loop and is explained by panel member Boone (see discussion of Component II.5 in Chapter IV). Based upon the literature and input from the panel of experts, the researcher concluded that the four components that

practitioners rated low as to amount of use are important to the training needs assessment process.

2. Practitioners rated three of the same four components low in terms of appropriateness to the training needs assessment process. However, by literature and by input from the panel of experts, the inclusion of these components in the training needs assessment process was reinforced.

3. Practitioners rated only one of the components, Identify Performance Differences (II.2) lower than the others in terms of willingness to use the component. Based upon the literature and input from the panel of experts, and because this component is so important to the training needs assessment process as emphasized in the literature, this concept needs to be stressed regardless of the practitioners' rating.

4. A conclusion that can be drawn from Part II of this study is that the model, as designed using a panel of experts and a Delphi process, is in general a model that can be accepted by a majority of the practitioners in technology transfer in the transportation industry. However, this conclusion was challenged by the comments in letters from practitioners.

5. This model has not been tested as part of an actual training needs assessment for technology transfer. The model has been perused by both experts and practitioners

and appears to contain components that will function in the training needs assessment process.

Recommendations

With respect to findings and conclusions of this study in identifying and rating components for a training needs assessment for technology transfer, the following recommendations are offered.

Recommendations Related to Part I, the Delphi Study

1. Before a Delphi study is undertaken, the researcher should read extensively on the use, misuse, and proper procedures for a Delphi study, and then follow the procedures carefully. Appendix B in this dissertation lists some references on how to conduct a Delphi study.

2. A criteria-building process for selection of a panel of experts needs to be included in the procedures outlining a Delphi study. Procedures similar to those used by Volk (1993) (see Chapter III) are suitable for this process.

3. The researcher should clearly define the extent to which the Delphi panel of experts will be used in the model-building process. Using the Delphi process for model-building is different from the quantitative studies done by Dalkey and Helmer. When using the Delphi process for model-building, it may be necessary to build into the research

process an extensive section of researcher-directed procedures. No researcher-directed procedures were found in the literature. The study design would have to use an innovative approach to accomplish this task.

4. A process for quantifying the results is essential to the model-building process. Summarizing consensus is extremely difficult when measurable numbers are not part of the process. Each Delphi study undertaken for the model-building process should include, as part of the initial research design, some method of stipulating the rating and ranking of the components. Dalkey and Helmer have methods for rating and ranking the rounds of the Delphi process in their procedures.

5. The Delphi process as a research tool has been in use for some time, but procedures and applications lack detail. Researchers using the Delphi process need to be creative and innovative in their research design. In reviewing studies in Linstone and Turoff (1975), it was noted that no two studies were conducted in the same way.

6. The Delphi process was developed in the high technology field of military target designation in the early 1960s before the development of personal computers and computer networks. The Delphi studies that this author has investigated still use the pencil-and-paper, mail, and analysis techniques used in the early studies. The Delphi process needs to be updated to join the electronic age and

to take advantage of the enhanced speed and efficiency of electronic media. E-Mail is the beginning of this process. An academic application of the Delphi process should be pursued by testing some of the many groupware products which can link personal computer users together in real time. A number of commercial software titles are available to be tested in these studies.

7. The researcher discussed the construction of the model with the major professor supervising this study. It was the opinion of the major professor and the researcher that the component Evaluate Existing Performance Levels (I.5) should be moved to Phase II, Investigation, and become component II.1. Distinguish between "Training" and "Nontraining" Needs (II.3) should become component I.5.

Recommendations Related to the Component-Rating Phase of the Study

1. The model developed by the experts and then rated by practitioners should be tested with other populations of technology transfer training professionals. Once the model has been implemented, field tested, and modified, it should be voluntarily used by the technology transfer programs as a base for their ongoing training needs assessments.

2. The model should be sent to all the FHWA-sponsored technology transfer programs, and instruction on implementing and using the model should be offered to those

programs which elect to use the model. This implementation is supported by the fact that 77% of the respondent practitioners conduct training needs assessments but only 30% of the practitioners had received any formal instruction in conducting a training needs assessment.

3. The fact that the practitioners rated the components dealing with performance measures lower than all of the other components infers that many of the practitioners are not aware of the importance of measuring job performance as it relates to training needs assessment. The practitioners should have exposure to educational planning methodologies on a regular basis. This exposure could be in the form of workshops, formal seminars, or a series of articles on educational planning.

4. Because many of the practitioners appeared to be disgruntled at the potential implementation of a change in their planning procedures, there should be a gradual implementation of the model into the technology transfer training environment. The model should be tested and used with those practitioners who are willing to implement it.

5. The population selected for Part II of this study was selected because of close ties to the technology transfer environment. This population is one of the few professional concentrations now in existence with an established technology transfer goal. This group is distributed nationwide. However, these practitioners get

together and talk about their problems at least four times per year. This study reveals only the demographics of the population; inferences cannot be made concerning the population. The reaction of the population was predictable. If plans are made for a group, and that group is not included in the plans, they resent it. This model can be employed on a limited basis with those technology transfer programs that honestly wish to improve their training needs assessment efforts. It needs to be emphasized that even though approximately 20% of the practitioners appeared to be disgruntled, over 60% rated the model as potentially useful.

Problems for Further Study

1. The training needs assessment model developed in this study needs to be field tested to determine its applicability for use in technology transfer programs. This study could be conducted using one of the existing FHWA-sponsored technology transfer programs. The implementation of the model would be a contribution to the body of knowledge about training needs assessment.

2. This study was prefaced in the literature review with work by Sork and Caffarella relating to discrepancies between what practitioners do and what scholars theorize should be done. The difference in the size, structure, and goals of the two populations in this study did not allow for statistical comparisons of the expert and practitioner

populations. It can be inferred from this study that future work can be done in the area of two-part studies. To compare diverse populations, an accepted research framework should be part of the procedure. Two-part studies could prove to be a valuable tool to accomplish this type of descriptive research.

3. Future research should be directed in the area of comparing what practitioners do and what scholars theorize should be done. This research should include attempts to include a larger population of experts and identify a diverse group of practitioners to rank order the training needs assessment components.

Discussion

Allison Rossett (1987), in her book entitled Training Needs Assessment, begins Chapter One with a brief history of the Instructional Systems Development (ISD) model. ISD has been used by practitioners of technical education for years as the most widely accepted performance-based training model. The ISD model was modified and accentuated by the Training Systems Development/Institute of Nuclear Power Operations (TSD/INPO) model and the Training Accreditation Program (TAP) model. The similarities of the ISD, TSD/INPO, and TAP models are inherent due to their derivative nature. The primary similarity is that all three are performance-based training models designed to accomplish the following

task--"to provide training that supplies the information necessary for the job incumbents to perform their assigned duties at a predetermined level of expertise" (Neal, 1992, p. 78).

In application, the ISD model assumes that a training needs assessment has been conducted and that a training need exists. Both the TSD/INPO and TAP models include a component entitled "Conduct Needs Analysis" (TSD/INPO) or "Determine Training Needs" (TAP). The weakness in all three models is that they do not provide a definitive model which presents the methodology for conducting a training needs assessment.

This study provided a basic model to be used to conduct a training needs assessment prior to undertaking a training system design. The use of the Delphi process and the qualified group of experts greatly assisted in identifying components for a training needs assessment. All three of the recognized training system design models will have a starting point from which to determine the needs of the performance-based training process.

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Appendices

Appendix A: Comparison of Training Needs Assessment Methods

Method	Definition	Example	Attributes
Analytic Method	An outside expert prescribes the training solution by analyzing information on the program being assessed.	The training is prescribed by a consultant who decides that training may solve the problem. An example would be bridge inspection. The expert prescribes certain training, based on maintenance needs.	1. An outsider assesses the need by information analysis. 2. An outsider prescribes a solution.
Democratic Method	Uses group consensus to guide a group process. The group attempts to reach a consensus by professional opinion.	This model would include the use of your T^2 Advisory Committee or potential sponsor. This may also include brainstorming with a group of experts in the field.	1. Needs are identified through consensus. 2. Professionals identify needs through expert opinion.
Diagnostic Method	A process of establishing that the denial of the need would be harmful.	This model is close to required training for commercial driver licensing. The sponsor's needs are dictated by regulations.	1. Denial of the need would prove to be harmful. 2. Both performance-based and non-performance-based needs are affected by denial. 3. Relates to required training. 4. Dictated by regulations.

Method	Definition	Example	Attributes
Individual Appraisal Method	Individuals or groups assess their own needs. The individual or group initiates the assessment and follows up on the process.	An example of this model would be a group like the Institute of Transportation Engineers or Americal Public Works Association asking the T^2 Center to put on a course they think is needed.	1. Needs are assessed by trainees either singularly or as a group. 2. Trainees identify their own deficiencies.
Individual Self-Fulfillment Method	A process randomly collecting perceived needs from a client group.	A T^2 example of this method would be a questionnaire mailed to potential participants, program sponsors (state departments of transportation), or other T^2 centers. The results would guide the training offered.	1. Needs are perceived as wants or desires by the trainers. 2. Needs are addressed by the number of trainers expressing their wants or desires. Majority rules. 3. Bias is introduced by the planner through preselection of proposed topics. 4. The individual self-fulfillment method promotes marketing of training efforts to trainees.
System Discrepancy Method	A process that defines the way things are and the way they should be. Defines the discrepancies between the existing and the ideal.	This model would use data, e.g., pothole inventory or work zone accident data, drainage incidents, or nonconformance to the Manual on Uniform Traffic Control Devices for discrepancies and propose the optimals vs. the actuals.	1. Inquiry identifies the way things are (actuals) and the way things should be (optimals). 2. The systems discrepancy method defines the deficiencies between the existing process and the ideal process. 3. The systems discrepancy method develops an intervention scheme for supplying a remedy.

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Appendix C: Biographical Sketches of Members of the Panel of Experts

Mr. Wright B. Aldridge, Jr.

Wright B. Aldridge, Jr., M.S., P.E., Planning, Environment, and Research Engineer, Federal Highway Administration, Tennessee Division. Mr. Aldridge's experience includes monitoring the transportation planning programs for the State of Tennessee and the state's nine urbanized areas and overseeing the environmental planning process, including approving environmental documents, for transportation projects within Tennessee. He works with the Tennessee Department of Transportation and the universities in the state in their research and technology transfer programs.

Dr. Edgar J. Boone

Edgar J. Boone, Ph.D., Professor and Director, Academy for Community College Leadership Advancement, Innovation and Modeling, Department of Adult and Community College, North Carolina State University, Raleigh, North Carolina. Dr. Boone has been Professor and State Extension Program Leader, University of Arizona, Tucson, Arizona, and County Extension Agent, Program Analyst, and Assistant Professor, Louisiana State University, Baton Rouge, Louisiana. Dr. Boone is past President of the Adult Education Association of the United States and President of the National Coalition of Adult Education Organizations. He is consultant to the U.S. Office of Education, the U.S. Department of Education, the U.S. Department of Agriculture, the American Council of Graduate Schools, the Southern Association of Colleges and Schools, and to 67 community colleges, 50 U.S. universities, and 21 international universities. He directed more than a dozen major research projects and published seven books, several book chapters, and numerous monographs, papers and articles in the areas of community-based programming in adult, community college and higher education. Dr. Boone was recipient of the 1988 Distinguished Service Award, U.S. Department of Agriculture, for community-based programming; the nation's Ruby Award (Epsilon Sigma Phi, 1989) for leadership in continuing professional education and programming; and a Fulbright Scholarship Award (1990).

Dr. Walter A. Cameron

Walter A. Cameron, Ph.D., Professor, Department of Technological and Adult Education and Director of Human Resources Development Office, The University of Tennessee. Dr. Cameron authored or co-authored 21 curriculum publications and 38 research and development publications and/or book chapters dealing with vocational training, industrial training, developing and delivering career information, implementation of quality, comprehensive needs assessment, and developing human resources. He works with business and industry in developing their human resources through training, occupational analyses, ongoing needs assessment, and implementation of continuous improvements strategies (quality). He teaches graduate level courses in research, needs assessment, and workforce planning.

Ms. Lisa H. Pogue

Lisa H. Pogue, M.A., Director of Technology Exchange and Training Assistance, American Public Works Association, Washington, D.C. Ms. Pogue presented a paper "Innovations and Lessons Learned by Technology Transfer (T^2) Centers in the United States" at an Organization for Economic Cooperation and Development seminar on technology transfer in Seville, Spain, in 1991, and made a presentation on the T^2 Clearinghouse to Pan American Institute of Highways Annual Meeting, Queretaro, Mexico, in 1992. She directs the Technology Transfer Clearinghouse (under contract with the FHWA) and manages training material development for LTAP national transit program (under contract to the Federal Transit Administration). She edits and publishes newsletters, prepares a national directory of training and technical resource materials, prepares financial reports and budgets, develops a video library and other technical assistance products, makes presentations at regional and national meetings, provides support for the LTAP advisory committee, and oversees research reports and publications. Ms. Pogue designs and coordinates a train-the-trainer workshop series, designs and contributes to newsletters, prepares reports on accomplishments of the LTAP program, and provides support to editorial committees of the National Program Review Board for the development of training materials.

Dr. Thomas J. Sork

Thomas J. Sork, Ph.D., Associate Professor of Adult Education in the Department of Administrative, Adult, and Higher Education at the University of British Columbia. Dr. Sork has worked as a continuing education program planner and administrator at Colorado State University, Florida State University, and the University of North Carolina. His current research and writing interests emphasize planning and resource allocation in adult education.

Appendix D: Letter Requesting Delphi Panel Participation

May 4, 1993

1~

Dear 2~:

Currently I am conducting a research project for my Doctoral Dissertation entitled, "The Determination of Effective Components for a Training Needs Assessment Model for Use by Technology Transfer Centers."

In my review of the literature, I have noted your extensive scholarly research and publication in the area of needs assessment in adult and continuing education. My doctoral committee comprised of the following individuals from The University of Tennessee have requested that I formulate an expert Delphi panel to determine the effective components at a training needs assessment for technology transfer.

Dr. Clifton P. Campbell, Major Professor Technological & Adult Education	Dr. Ralph G. Brockett Technological & Adult Education
Dr. Roger L. Bowlby, Professor Economics	Dr. Gregory C. Petty Technological & Adult Education

Your involvement in this project will be greatly appreciated and I hope will prove to be mutually beneficial.

I will be contacting you in the immeditate future to discuss this project.

Sincerely,

Danal W. Neal
Program Director

DN/sm

Appendix E: Letter and Questionnaire for Round 1

May 18, 1993

Mr. Wright B. Aldridge, Jr., P.E.
Planning, Environment, and Research Engineer
Federal Highway Administration
Tennessee Division
249 Cumberland Bend Drive
Nashville, Tennessee 37228

Dear Mr. Aldridge:

Thank you for working with me on the important topic of training needs assessment for technology transfer.

The following story, excerpted from Patterns of Problem Solving by Moshe F. Rubinstein, places our task in a historical perspective:

> THE DELPHI METHOD
> (The name Delphi comes from the site of an ancient Greek temple where the gods of Greek Mythology gathered to profess their prognosis of the future.)
>
> Historical Preview to the Subject of Consensus
>
> In the years between 285 B.C. and 246 B.C., King Ptolemy ruled in Egypt. Ptolemy was a strong supporter of Greek culture. Story has it that when he decided to undertake translation of biblical writings into Greek, he approached the high priest in Judea and requested the assistance of scholars who were well versed in both Hebrew and Greek. The high priest sent 70 scholars,† and the translation, therefore, later became known as the *septuagint* after the word *septuaginta*, seventy in Latin.
>
> The story continues, then, to tell us that Ptolemy brought the scholars to Alexandria, placed each one in a separate room in isolation so that they could not communicate with each other or anyone in the outside world. The scholars set about their translation job without interruption, completed their work on schedule, and presented their translations to Ptolemy. An independent review committee inspected the 70 translations, and legend has it that they were found to be identical to the iota. This was such an unbelievable coincidence that the whole world known at that time was astonished to learn the story. The story

traveled from city to city, from market place to market place, from gymnasium to gymnasium, until it finally reached Judea and got to a little town that was the home of one of the scholars who participated in the translation.

A young resident of the town, having heard the story from a traveler, rushed into the Rabbi's home and, full of excitement, related to him the miracle of the identical translations. The Rabbi, an old experienced man, listened with great patience and then turned to the young man: "Seventy scholars in separate rooms, and this you call a miracle? Put them in one room and get the same translation--this is a miracle."

†Another version claims that he actually sent 72 scholars, 6 from each of the 12 tribes.

To avoid problems with validation, we will be using the Delphi method outlined by Norman Dalkey and Olaf Helmer in the original studies for the Rand Corporation.

The procedure will use a series of five (5) questionnaires and should flow to conclusion.

Questionnaire 1 is attached. Please take a moment to respond to this initial important listing of the **effective components of a training needs assessment model for technology transfer.**

Sincerely,

Danal W. Neal
Program Director

DWN:njm
Enclosures

QUESTIONNAIRE 1

This is a part of a continuing study to arrive at determining the effective components of a training needs assessment model for technology transfer.

Please do not discuss this study with others while this experiment is in progress, especially with the other subject experts. You are at liberty, though, to consult whatever data you feel might help you in forming an opinion.

The problem with which we will be concerned is the following:

- Technology transfer is the training innovation that will lead technical training into the twenty first century.

- This innovation, coupled with the government's projections for rebuilding the country's infrastructure and transportation system, makes an effective training needs assessment model vital to the transportation industry.

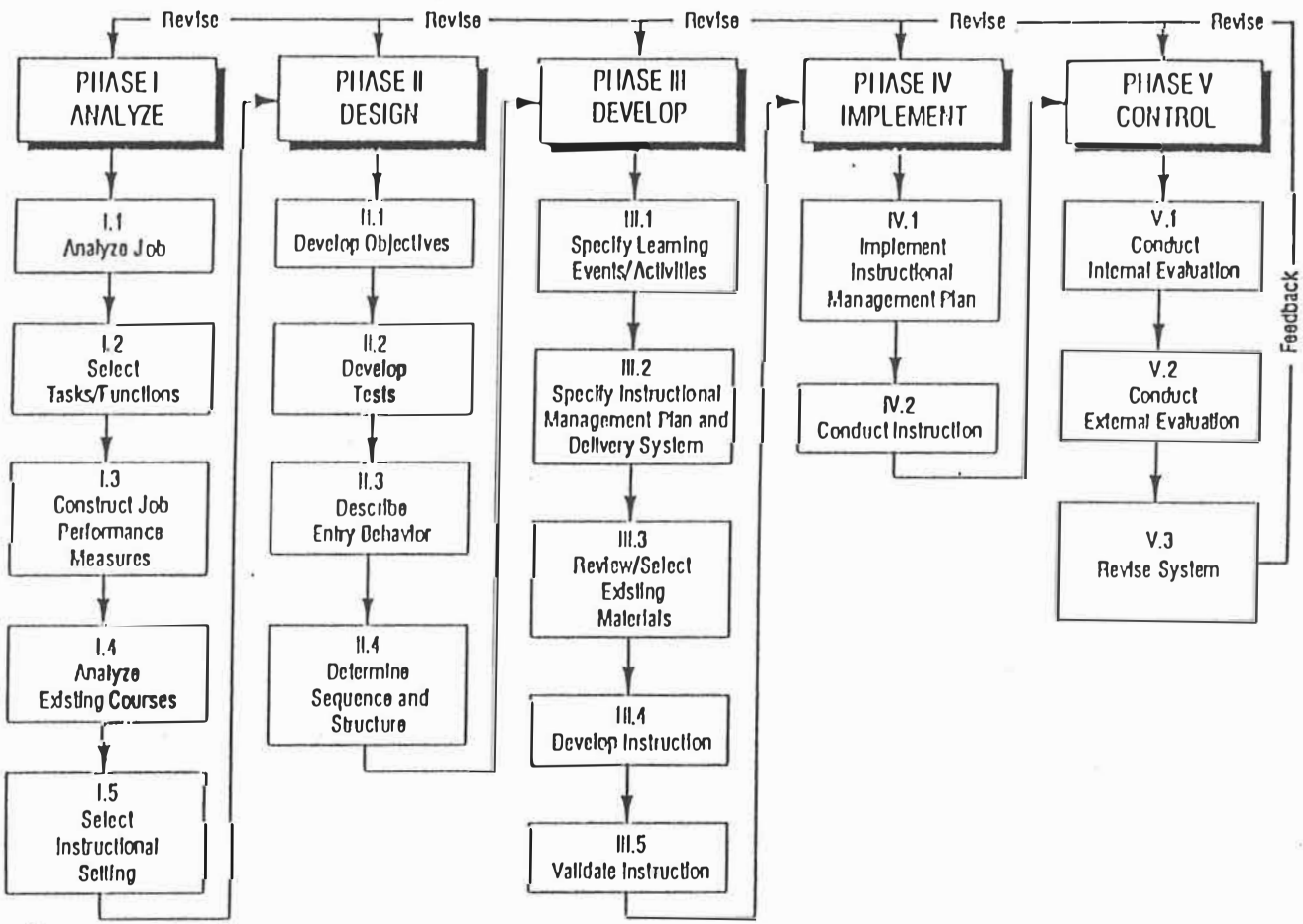
Instructional Systems Design (ISD) has become an accepted model to Analyze, Design, Develop, Implement and Control the training process. Please see the attached (ISD) model.

ISD assumes that a training needs assessment has been completed.

Numerous distinguished authors have addressed the subject of Training Needs Assessment (TNA). A model for TNA is needed to precede the ISD process.

This question to you, the experts, will be referred to as the "primary question."

What are the effective components of a training needs assessment model for technology transfer?



Instructional Systems Development (ISD) model.

First Questionnaire

Please list the effective components of a training needs assessment model.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

---More if Needed---

Appendix F: Follow-up Fax to Round 1 Questionnaire

FAX TRANSMITTAL
FROM
TRANSPORTATION CENTER
The University of Tennessee
357 South Stadium Hall
FAX (615) 974-3889
Phone (615) 974-5255

PLEASE DELIVER THE FOLLOWING PAGES TO:

Name: Mr. Wright B. Aldridge

Address:

Planning, Environment, and Research Engineer
Federal Highway Administration
Tennessee Division
249 Cumberland Bend Drive
Nashville, Tennessee 37228

Telephone: (615) 736-7106 FAX No: (615) 736-5467

From: Danal W. Neal

Date: May 26, 1993

Total number of pages including cover page: 1

If you do not receive all the pages or have problems with transmission, please call (615) 974-5255 and ask for

COMMENTS: By now I hope you have had a chance to think about the **effective components of a training needs assessment model for technology transfer.**

To assist in collecting this data, I would appreciate your initial listing by June 11, 1993.

If I can be of any assistance, please feel free to call.

Appendix G: Cover Letter for Round 2

June 21, 1993

Mr. Wright B. Aldridge, Jr., P.E.
Planning, Environment, and Research Engineer
Federal Highway Administration
Tennessee Division
249 Cumberland Bend Drive
Nashville, Tennessee 37228

Dear Mr. Aldridge:

Thank you for your timely completion of Questionnaire, 1. The effective components of a training needs assessment model for technology transfer, as determined by a well qualified panel of experts, have been identified. Your diligent efforts concerning this process are appreciated.

I have classified your responses into two major headings. The headings are:

- Conceptual Planning
- Systems Planning

I have attempted to then develop fourteen subheadings in each major heading. The effective components are listed verbatim under the subheadings. My original compilation included component author, however, I am eliminating that for anonymity.

Please peruse the major headings, subheading and components, and feel free to reassign headings or components. I have also enclosed a sheet for comments.

Due to the summer months, some of our panel are traveling. However, I would appreciate your initialling the attached compilation with your changes and comments, and returning it to me by July 9, 1993. I have enclosed an envelope for your use.

The next questionnaire will be a closed-end (Likert) scale, from 1 to 7, to rate each classified and identified component. Once this is concluded, I will compile the results and forward them to you along with a copy of my dissertation prospectus.
Thank you again for your valuable time and knowledge.

Sincerely,

Danal W. Neal
Program Director

Enclosures
DWN:njm

Appendix H: Cover Letter Accompanying Preliminary Model

September 10, 1993

1~

Dear 2~:

I have reviewed all of the comments from round two of our model development Delphi study for a training needs assessment for technology transfer. Once again, thank you for your input and evaluation.

Dr. Cliffton Campbell, my major professor, has returned from summer term and has reviewed our progress to date. He is impressed with the work that has been accomplished, and has approved all of the work that has occurred to date. Dr. Campbell is requesting that I have each of you review the enclosed **PRELIMINARY MODEL** entitled "Proposed Training Needs Assessment (TNA) for Technology Transfer."

The model includes five phases delineated from round two of our study. The phases are listed below. Please peruse the phases and add any additional comments in this our third round of this delphi study.

- Phase I, Context Evaluation
- Phase II, Input Evaluation
- Phase III, Process Evaluation
- Phase IV, Product Evaluation
- Phase V, Impact Evaluation

Each of your individual components identified in round one and revised in round two will be quoted verbatim in the narrative of the model building process. All of your input is too important to not list in its entirety.

If you are satisfied with the preliminary model, and feel that each of your original components have been satisfactorily incorporated, please indicate you approval on the attached comments sheet. I would appreciate your returning the information to me by September 17, 1993.

The next phase of the study, barring any major corrections, will be the quantifying process mentioned in our last letter. It is my goal to complete and defend this study by February, 1994.

If you have any questions, please feel free to call me at (615) 974-2782. Thank you again for your valuable time and input.

Sincerely

Danal W. Neal
Program Director

Enclosures
DWN/njm

Appendix I: Letter Explaining Changes in Phase Headings

December 3, 1993

Mr. Wright B. Aldridge, Jr., P.E.
Planning, Environment, and Research Engineer
Federal Highway Administration, Tennessee Division
249 Cumberland Bend Drive
Nashville, Tennessee 37228

Dear Mr. Aldridge:

The development of our training needs assessment model for technology transfer is proceeding well. The rating sheets have been collected from approximately 75% of the T^2 Centers.

In a further review of the literature on education in general, the CIPPI acronym proved to conflict with another model used to rate staff development in education. To alleviate this potential conflict in the literature, I have changed the phases as follows (see attached revision).

- Phase I Background
- Phase II Investigation
- Phase III Implications
- Phase IV Outcome
- Phase V Impact

There were no other changes in the structure of the model or its components. I hope that these modifications in the labeling of the phases do not change your previous consensus concerning the model.

I will keep you posted on the development of the project. I am preparing to present preliminary results at the Transportation Research Board (TRB) in Washington, D.C. in January of 1994, and am planning on defending the dissertation in March of 1994.

Again, thank you for your assistance and involvement.

Sincerely,

Danal W. Neal
Program Manager

Enclosure
DWN:njm

Appendix J: Initial Letter to Technology Transfer Programs

May 6, 1993

Alabama Technology Transfer Program
ATTN: William A. Segraves
Engineering Extension Service
107 Ramsey Hall
Auburn University, AL 36849-5331

Dear Mr. Segraves:

Currently I am working on my Doctoral Dissertation in connection with the Federal Highway Administration. The title of my dissertation is "The Determination of Effective Components for a Training Needs Assessment Model for Use by Technology Transfer Centers." Enclosed is a copy of the FHWA proposal for your review.

The purpose of this communication is to briefly explain the project and solicit your cooperation and involvement.

The purpose of the project is as follows:

- To define and describe the process of needs assessment.
- To develop a needs assessment model for technology transfer incorporating effective components.

I understand that many of the T^2 Centers are extremely successful, and that there is already a great deal of networking occurring among T^2 Centers. It is my hope that this project will assist in this ongoing networking process and help to assimilate the best of all our programs.

I will be sending additional information concerning this project to your T^2 Centers. Please let me know who from your Center will be designated as my contact person for this project.

Sincerely,

Danal W. Neal
Progam Director

DWN/njm
Enclosures

Designated Contact Person to T^2 Planning Project

Name:_____

Title:_____

Organization:_____

Street Address:_____

City, State, Zip:_____

Phone:_____ FAX:_____

Please return to:

The University of Tennessee
Transportation Center
ATTN: Danal W. Neal
354 South Stadium Hall
Knoxville, TN 37996-0700
Phone: (615) 974-5525
FAX: (615) 974-1838

Appendix K: FHWA-Sponsored Technology Transfer Programs

Alabama Technology Transfer Program
ATTN: William A. Segraves
Engineering Extension Service
107 Ramsey Hall
Auburn University, AL 36849-5331

Transportation T^2 Program
DOT&PF
ATTN: Sharon McLeod-Everette
2301 Peger Road, M/S 2550
Fairbanks, AK 99709-5316

Arizona Technology Transfer Program
ATTN: Judson Matthais, Director
Center for Advanced Research in Transportation
Arizona State University
Tempe, AZ 85287-6306

Arkansas Technology Transfer Program
ATTN: Dr. Thomas Knight, Director
P.O. Box 2261
Little Rock, AR 72203

California T^2 Center, ITS Extension Program
ATTN: Anna Bennett, Director
University of California - Berkeley
Richmond Field Station
1301 S. 46th St., Bldg. 452
Richmond, CA 94804

Colorado Transportation Information Center
ATTN: Richard M. Gutkowski, Director
Colorado State University, ERC A307
Fort Collins, CO 80523

Connecticut Transportation Institute
ATTN: Gerald W. McCarthy, Director
191 Auditorium Road
U-37-TI
University of Connecticut
Storrs, CT 06269-3139

DelDOT T^2 Center
ATTN: Lawrence Klepner, Director
P.O. Box 778
Dover, DE 19903

Florida Technology Transfer Center
ATTN: Charles E. Wallace, Director
512 Weil Hall
Gainesville, FL 32611-2083

Georgia Department of Transportation
Technology Transfer Center
ATTN: Phil Bryant, Director
Room 301, No. 2 Capitol Square
Atlanta, GA 30334-1002

Hawaii Technology Transfer Center
ATTN: Paul D. Fetherland, Director
Technical Assistance Program
University of Hawaii
2444 Dole Street
Bachman Hall 112
Honolulu, HI 96822

Idaho Technology Transfer Center
ATTN: John E. Wanamaker, Director
Idaho Transportation Department
Local Roads Section
P.O. Box 7129
Boise, ID 83707-1129

Illinois T^2 Center
ATTN: Dennis Whitehead
2300 South Dirksen Parkway, Rm 205
Springfield, IL 62764

Highway Extension & Research Project for
Indiana Counties and Cities (HERPICC)
ATTN: Charles F. Scholer, Director
Civil Engineering Building
Purdue University
West Lafayette, IN 47907-1284

Iowa Transportation Center
ATTN: Tom Maze, Director
382 Town Engineering Building
Iowa State University
Ames, IA 50011-3233

Kansas University Transportation Center
ATTN: Joe Lee, Director
Technology Transfer Center for
Rural Transportation
2011 Learned Hall
Lawrence, KS 66045

Kentucky Transportation Center

ATTN: Patsy Anderson, Director
University of Kentucky
211 Transportation Research Building
Lexington, KY 40506-0043

Technology Transfer Program
ATTN: E.J. Foreman, Director
4101 Gourrier Avenue
Baton Rouge, LA 70808

Maine Local Roads Center
ATTN: Mr. Peter M. Coughlan
& George W. Greenwood, Co-Directors
Maine DOT
Technical Services Division, Station 16
Augusta, ME 04333

Technology Transfer Center
ATTN: Harold T. Rib
& Everett Carter, Co-Directors
Department of Civil Engineering
University of Maryland
College Park, MD 20742

Baystate Roads Program
ATTN: Paul W. Shuldiner, Director
Department of Civil Engineering
University of Massachusetts
Marston Hall, 214F
Amherst, MA 01003

Transportation Technology Transfer Center
ATTN: Bernard Alkire, Director
Michigan Technological University
1400 Townsend Drive
Houghton, MI 19931

MN Transportation Technology Transfer Studies
ATTN: Cheri Trenda, Director
Education/Extension Programs
500 Pillsbury Drive SE
110 Civil and Mineral Engineering Bldg.
Minneapolis, MN 55455

Mississippi Center for Technology Transfer
ATTN: Otha Burton, Jr., Director
Jackson State University
P.O. Box 18125
Jackson, MS 39217-0625

Technology Transfer Assistance Program
ATTN: James J. Radmacher, Director
Missouri Highway & Transportation Dept.
P.O. Box 270
Jefferson City, MO 65102

Local Technical Assistance Program
ATTN: John Hopkins, Director
Dept. of Civil/Agricultural Engineering
Montana State University
Bozeman, MT 59717-0390

Nebraska Technology Transfer Center
ATTN: Bill Bowmaster, Director
205 Nebraska Center
33rd & Holdrege
Lincoln, NE 68583-0929

Nevada Technology Transfer Center
ATTN: Dr. Jon Epps, Director
College of Engineering
256 University of Nevada/Reno
Reno, NV 89557-0030

New Hampshire Technology Transfer Center
ATTN: John A. Anderson, Director
University of New Hampshire
231 Kingsbury Hall
Dept. of Civil Engineering
Durham, NH 03824

Rutgers Road Technology Transfer Center
ATTN: Claudia Knezek, Director
Rutgers University
Dept. of Government Services
Building 4161 Livingston Campus
New Brunswick, NJ 08903

New Mexico Technology Transfer Program
ATTN: Don Beck, Director
RIAC Building 735
P.O. Box 5878
Roswell, NM 88202-5878

Cornell Local Roads Program
ATTN: Lynne Irwin, Director
416 Riley-Robb Hall
Cornell University
Ithaca, NY 14853-5701

Technology Transfer Program at UNC-ITRE
ATTN: James Martin, Director
P.O. Box 17489
Raleigh, NC 27619-7489

Technology Transfer Center
ATTN: Donald Andersen, Director
Civil-Industrial Engineering Bldg.
North Dakota State University
Fargo, ND 58105

Ohio Technology Transfer Center
ATTN: Zoltan Nemeth, Director
470 Hitchcock Hall
2070 Neil Avenue
Columbus, OH 43210-1275

Center for Local Government Technology
ATTN: Joseph Paden, Director
308 CITD
Stillwater, OK 74078

Oregon Technology Transfer Center
ATTN: Mr. William J. Quinn, Director
800 Airport Road SE
Salem, OR 97310

Pennsylvania Local Roads Program
ATTN: William Pogash, Director
Office of Research and Special Studies
905 Transportation and Safety Bldg.
Harrisburg, PA 17120

Puerto Rico Transportation Technology
Transfer Center
ATTN: Benjamin Colucci
& Felipe Luyanda, Co-Directors
Civil Engineering Building
University of Puerto Rico, Mayaguez Campus
Mayaguez, PR 00680

Rhode Island T^2 Center
ATTN: Rene Fontaine
Division of Planning
1 Capitol Hill
Providence, RI 02908

Transportation Technology Transfer Service
ATTN: J. Edwin Clark
& Donald B. Stafford, Co-Directors
Department of Civil Engineering
Clemson University
Clemson, SC 29634-0911

South Dakota Transportation Technology
Transfer Service
ATTN: Ali A. Selim, Director
South Dakota State University
Box 2220, Harding Hall
Brookings, SD 57007-2220

Tennessee Transportation Assistance Program
ATTN: Don H. Jones, Director
Transportation Center
The University of Tennessee
Knoxville, TN 37996-0700

The Texas A & M University System
ATTN: Nelson Evans, Director
College Station, TX 77843-8000

Utah T^2 Center
ATTN: W.J. Grenney, Director
Utah State University, UMC 4111
Logan, UT 84322-4111

Vermont Local Roads Program
ATTN: Henry R. Lambert, Director
Saint Michael's College
Colchester, VT 05439

Virginia Transportation Technology
Transfer Center
ATTN: Thomas Freeman, Director
Box 3817, University Station
Charlottesville, VA 22903

Northwest T^2 Center
ATTN: Dennis Ingham, Director
WSDOT - Local Programs
Transportation Bldg, KF01
Olympia, WA 98504-7390

WV Municipal Street & Highway Program
ATTN: Ronald Eck, Director
WVU Department of Civil Engineering
P.O. Box 6101
Morgantown, WV 21610-6101

Transportation Information Center
ATTN: Donald Walker, Director
University of Wisconsin - Madison
432 North Lake Street, Room 741
Madison, WI 53706

Wyoming T^2 Center
ATTN: Eugene M. Wilson, Director
University Station Box 3295
Dept. of Engineering
Laramie, WY 82071

Northwest Tribal Rural Technical Assistance Program
ATTN: Dick Winchell,
Eastern Washington University
MS-10, Dept. of Urban and Regional Planning
Cheney, WA 99004

Appendix L: Survey Instrument for Practitioners

FHWA T² RESEARCH QUESTIONNAIRE THE DETERMINATION OF EFFECTIVE COMPONENTS FOR A TRAINING NEEDS ASSESSMENT MODEL FOR USE BY TECHNOLOGY TRANSFER CENTERS

A panel of experts have identified the following Components for a Training Needs Assessment for Technology Transfer. These components have been assembled into five phases. Please see the enclosed PRELIMINARY MODEL for clarification.

I. RANKING OF COMPONENTS

For each component in each phase of the model, please assess each of the following:

a. The importance of this training needs assessment component to your operations.

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

d. Your Technology Transfer Center's willingness to use the component.

II. RATING SYSTEM

This scale indicates the following assessment:

1 2 3 4 5 6 7

⇓ ⇓

Low importance, amount of use, appropriateness, and willingness to use.	High importance, amount of use, appropriateness, and willingness to use.

PHASE I CONTEXT EVALUATION

I.1 Define the term "Need" (please circle rating)

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

I.2 Determine the Setting for TNA

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

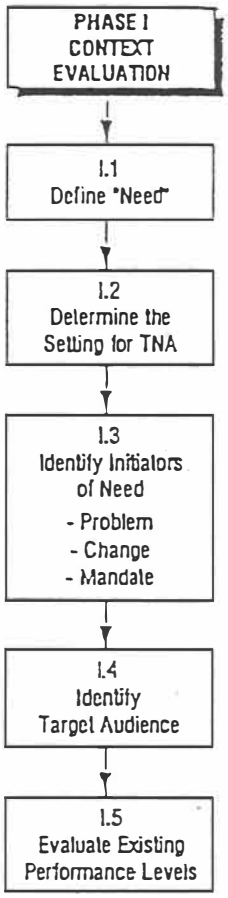
1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7



I.3 Identify Initiators of Need

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

I.4 Identify Target Audience

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

I.5 Evaluate Existing Performance Levels

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

PHASE II INPUT EVALUATION

II.1 Determine Optimal Performance

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

II.2 Identify Performance Differences

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

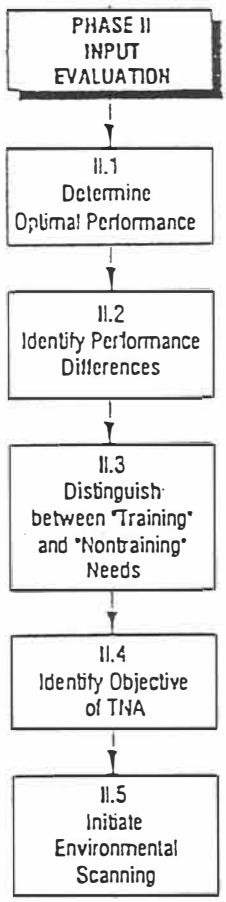
1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7



II.3 Distinguish between "Training" and "Nontraining" Needs

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

II.4 Identify Objective of TNA

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

II.5 Initiate Environmental Scanning

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

PHASE III PROCESS EVALUATION

III.1 Determinrmine Alternative Solutions

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

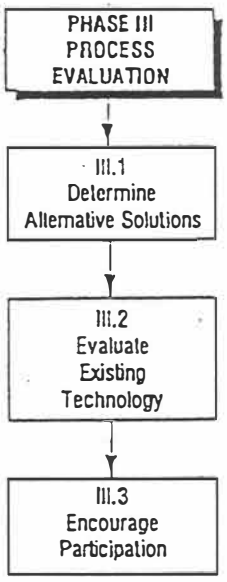
1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7



III.2 Evaluate Existing Technology

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's williingness to use the component.

1 2 3 4 5 6 7

III.3 Encourage Participation

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

PHASE IV PRODUCT EVALUATION

IV.1 Evaluate Costs

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

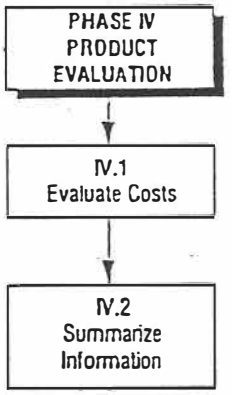
1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7



IV.2 Summarize Information

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

PHASE V IMPACT EVALUATION

V.1 Develop Plan to Integrate Results of TNA

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

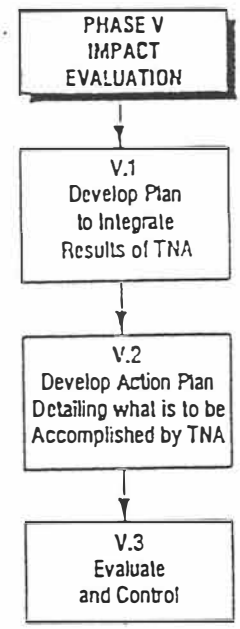
1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7



V.2 Develop Action Plan Detailing What is to be Accomplished by TNA

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

V.3 Evaluate and Control

a. The importance of this training needs assessment component to your operations.

1 2 3 4 5 6 7

b. The amount of use of the component in the planning procedures of your Technology Transfer Center.

1 2 3 4 5 6 7

c. The appropriateness of the effective component and its usefulness to your Technology Transfer Center.

1 2 3 4 5 6 7

d. Your Technology Transfer Center's willingness to use the component.

1 2 3 4 5 6 7

III. DEMOGRAPHICS

A. Education background of the Technology Transfer Center Planner

1. Level of formal education

Bachelor's Degree		Yes	No
Primary Field:			
Secondary Field:			
Master's Degree		Yes	No
Primary Field:			
Doctoral Degree		Yes	No
Primary Field:			
Cognate Area:			

2. Academic preparation in needs assessment, and experience with the needs assessment process:

a. Have you received any formal instruction in conducting a training needs assessment?

Yes _____ No _____

b. If yes, number of courses in the field?

_____

c. Have you conducted a training needs assessment in your T^2 Center?

Yes _____ No _____

d. If yes, number of needs assessments conducted?

1 - 5 _____
6-10 _____
11-15 _____
16-20 _____
over 20 _____

Appendix M: Cover Letter for Survey Instrument Sent to Practitioners

October 11, 1993

Alabama Technology Transfer Program
ATTN: William A. Segraves
Engineering Extension Service
107 Ramsey Hall
Auburn University, AL 36849-5331

Dear Mr. Segraves:

In May 1993 I informed you of a project that the Federal Highway Administration had undertaken to assist Technology Transfer Centers in the training needs assessment process.

The project has become entitled The Determination of Effective Components for a Training Needs Assessment Model for Use by Technology Transfer Centers.

Over the last few months, a panel of experts have been conducting an extensive Delphi study to identify the effective components for a training needs assessment.

The experts have developed the **Training Needs Assessment (TNA) for Technology Transfer (TNATT), Context, Input, Process, Product, Impact (CIPPI) Model.** A copy of the model is attached for your review.

An important part of this study is to incorporate a practitioner's perspective into the development of this model. **It is my understanding that you are in charge of educational planning for your T^2 Center. If you are not, please refer this questionnaire to the person who is in charge of planning technology transfer activities.** Enclosed is a questionnaire which will greatly facilitate your input into making this model more relevant to the day to day operations of a Technology Transfer Center for the Federal Highway Administration. The questionnaire covers the eighteen components identified by the panel of experts and is rated in four areas. Please note that there are two parts to the questionnaire. They are as follows:

- The quantitative rating for each of the 18 components.
- The demographic information found on page 13.

Your timely completion and return of this questionnaire will be greatly appreciated. Ms. Janet Coleman from the U.S. Department of Transportation, Federal Highway Administration, Office of Technology Applications has requested my presentation of this information at the Transportation Research Board (TRB) meeting in January 1994.

If you have any questions concerning this project, please call me at (615) 974-2782. Please mail the questionnaire in the enclosed self addressed envelope, or if you wish, you may FAX the results to me at (615) 974-3726.

Sincerely,

Danal W. Neal
Program Director

Enclosures
DWN:njm

Appendix N: Practitioner Comments

. . . While we agree that a "needs" assessment must be made, we are not sure that a process as complicated as this is needed.

We have no idea of how such an assessment could be made. However, if we were to take this process out to our locals, they would probably respond with "You've got to be kidding?" They do not like anything that will take up more than 5 to 10, possibly 15 minutes of their time. The . . . locals would most likely resist the T^2 staff undertaking such an involved process. They seem to like our informal one-on-one contact to learn about their needs and desires.

. . . Again, we strongly agree that determining the needs of the local clients is necessary. What we do not agree with is the process being too complicated, as indicated by the outline provided.

. . . As the Director of the . . . T^2 Center, I can attest to the need for an effective procedure for determining not only the training needs of our clientele but of their technology transfer needs.

I found the model and the questionnaire to be theoretical, vague, sometimes just stating the obvious and sometime irrelevant. You will note that I have included many written comments in the margins of the questionnaire. If the "expert panel" which is developing the "training needs assessment model" can not develop a more effective questionnaire to provide input to the model development, how are they going to develop a useful model?

I must advise you that my overall appraisal of the model is that it does not provide us with any worthwhile or useful information regarding the conduct of a training needs assessment; and the questionnaire will not provide you with any useful information on what T^2 practitioners think should be included in a training needs assessment model.

. . . The survey instrument was found to be vague. Without clear definition of survey components, such as "need," "setting," alternative solutions," "initiators," "performance differences," etc., completing the survey would lead to inaccurate results. Training needs assessments are fairly common and do not have to be as complex as presented.

. . . Because I have been the Manager of the . . . Technology Transfer Center for less than three weeks, I will not be returning your questionnaire. I expect it is better to have missing data than someone's guesses.

We are preparing a needs assessment of local road managers in ____. The initial survey distribution will be via our next newsletter, and the results published in a subsequent edition. Perhaps something from our experience will help you in your project.

Best wishes for a successful project.

. . . I hope our response provides good input. I must admit the intent was a little obscure.

This is the ***fourth time*** I have sat down and tried to complete the questionnaire you sent me for the Training Needs Assessment Model and I still don't know what it says. I am sorry to be so blunt, it looks like a lot of work went into the model, however, at this point I don't see how it could be useful to a T^2 center.

It is too academically oriented. When I receive a document with a title as long as the one on your questionnaire and a first sentence that begins with "A panel of experts have identified . . ." my inclination is to immediately stop reading and file it. That is probably a bad thing for me to do, however, with the amount of mail and information flowing through my office I must decide quickly what will be useful to the center and our customers.

I need a TNA model that is written in easy to understand English, which makes logical sense, and which will quickly produce useable results (preferably on a computer). What I received is wordy, hard to follow and technically oriented - maybe "expert friendly" is a better way to say it. It reads like a dissertation.

. . . I am returning the questionnaire you sent out some time back. I hope I am not the only person who had a problem with this. The jargon is there but I found it to be tedious. That is the reason I didn't return it earlier.

I would imagine that when all is said and done we'll know that we need to find out what our clients need to know, determine whether or not that need can be met by training, develop programs and courses that help them learn what they need to know, measure their performance against some standard, evaluate the results in terms of costs vs.

benefits, and feed that information back to ourselves so we can make the changes necessary to improve the information, delivery, or materials, or make it more economical to use.

. . . I would rather have had the money and spent the time finding out what our highway department secretaries in . . . need to know about using computers in their offices and how they can become more productive and more valuable to their superintendents.

. . . I am returning your questionnaire unanswered because, quite frankly, I do not understand the questions. If I were to respond, therefore, I would provide biased results.

I am completely unfamiliar with your model. Therefore, we do not use it. Nor could I identify exactly what your model was about from the figure containing boxes with short phrases written in the boxes, lines, and arrows. Am I missing a more complete description? If so, please send it to me, and I will be glad to critique it.

At the . . . Center, we take assessing the needs of our clients very seriously. However, in a technical sense, we do not conduct a needs assessment. We have a series of committees consisting of staff from local governmental agencies who attempt to articulate their training needs. Since the needs identified directly by these committees exceed our resources, we have never considered a more sophisticated system for assessing our clients needs.

. . . The last thing I want to do is be critical, but this so-called "TNA" and all the acronyms is completely useless to me and many other T^2 Centers. The 1st problem I had with this survey is trying to figure out what it meant! I spent more time on this than actually filling out the survey. Delphi study--components, phases--initiators of need--environmental scanning. I kept saying to myself--WHAT? HUH????

. . .Who was the "panel of experts?"

. . . Enclosed is the completed TNA Questionnaire you requested, I, too, had questions regarding term definitions. Generally, my reaction to this process was that it is unrealistic to think the T^2 Centers--with <u>limited</u> staff & budget--would be able to denote the resources necessary to construct such a <u>thorough</u> TNA process. The process itself generally looks acceptable with some components being essential, its just that is it practical to expect such thoroughness? Does the benefit outweigh the costs of the process?

Vita

Danal Wayne Neal was born in Dayton, Ohio, on November 10, 1946, the son of Mr. and the late Mrs. Samuel W. Neal. He attended public schools in Fairborn, Ohio, and graduated from Fairborn High School in 1965. He received a Bachelor of Science in Education from Miami University in Oxford, Ohio, in 1969 with a major in Industrial Education. He taught industrial education courses in the Northmont and Kettering public school systems in the Dayton, Ohio, area for four years.

Mr. Neal left public education in 1973 and began a new career in the construction industry as a Training and Education Director for the Associated General Contractors of America, West Central Ohio Division. While serving in this position, he earned a Master of Science degree in Personnel and Industrial Relations at Wright State University in Dayton, Ohio, in 1979.

Danal Neal left the Dayton, Ohio, area in 1980 and assumed a position as Executive Director with the Associated General Contractors of America (AGC), East Tennessee Chapter. From 1980 to 1982 he coordinated labor relations activities on the site of the 1982 World's Fair in Knoxville, Tennessee. He resigned the AGC in 1984 and assumed the position of Manager of Training and

Development for the Rust Engineering Company in Oak Ridge, Tennessee.

In 1989 Mr. Neal accepted a position with the Transportation Center at The University of Tennessee as Training Manager in charge of technology transfer and technology development. In June 1990 he enrolled in graduate school at The University of Tennessee and began working on the Doctor of Education Degree with a major in Technological and Adult Education. Mr. Neal is currently a Program Administrator with the Institute of Technology Management at The University of Tennessee.

Mr. Neal is married to Linda Sue Crossley-Neal and they have two children, a son Michael and a daughter Emily.