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Concept Mapping in Evaluation Practice and Theory:

A Synthesis of Current Empirical Research

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Masters Thesis

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July 1998

Abstract

Concept mapping is a conceptualization process that can be used by individuals and groups to develop conceptual frameworks which can guide evaluations and planning (Trochim, 1989). In research, these processes display individual and group representations of concepts about particular domains, illustrating potential relationships among them (Miles, 1994). Cognitive mapping processes involve the acquisition, store, access and utilization of spacial knowledge (Golledge, 1986). Empirical research using concept mapping technology has proliferated within the past fifteen years. Investigation of this research has revealed the existence of a wide variation of domains of inquiry and applications of concept mapping. Using non-traditional meta-analytic research techniques employed in prior reviews by Cousins and associates (Cousins, 1996; Cousins & Earl, 1992; Cousins & Leithwood, 1986; Ross, in press) and others (e.g., Leithwood & Montgomery, 1982), the empirical research studies are explored with relevance to evaluation theory and practice. Emphasis on concept mapping process variations and use in evaluation is ordered. This study provides researchers and evaluators with valuable empirical basis from which to make choices regarding selection and applications of concept mapping.

Acknowledgement

The author acknowledges thesis supervisor Professor Brad Cousins, University of Ottawa for his continued guidance and support on this project. The author also wishes to acknowledge Professors Colla MacDonald, University of Ottawa and Marielle Simon, University of Ottawa for their participation and support as members of the thesis committee. As well a special thanks to the author's family and friends for their support and encouragement over the last few years.

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CHAPTER 1: INTRODUCTION

Statement of the Problem

Concept mapping is a structured conceptual process that has evolved in many different academic disciplines (Bonham, 1993). As a systematic, methodological process concept mapping can be a useful tool for developing and directing evaluation theory and practice (Trochim, 1989). For example, conceptual frameworks in a specific domain of knowledge can be developed through the concept mapping process (Cropper, Eden & Ackerman, 1990; Novak, 1990). Relationships among these concepts can be displayed and used for developing and guiding research in any particular domain (Miles & Khattri, 1994). Concept mapping in evaluation has evolved considerably over the past few decades and sufficient empirical research using such methods has accumulated to warrant a review and synthesis of contributions in the area.

The present study synthesizes existing knowledge generated through empirical applications of concept mapping in relation to evaluation theory and practice. An abundance of literature and research involving concept mapping in evaluation has accumulated over the past fifteen years. Variations in the approach have provided for a wide range of concept mapping applications and substantial methodological diversity. Despite the increasing diversity of use of concept mapping applications, to date, minimal exploration about its contributions to evaluation theory and practice have been provided. The present study seeks to systematically examine such contributions.

Meta-analysis of a given body of empirical research can provide a basis from which theoretical contributions can be extracted. In meta analysis a body of empirical literature is systematically examined and analysed with the goal of synthesizing knowledge that has been produced in the area. Typically empirical work that is subjected to meta analysis predominantly employs quantitative methodologies. In the present study a modified approach to meta analysis, one that is suited to a wide range of methodologies is employed. Through a systematic review of the empirical literature using concept mapping in evaluation contexts, applications in evaluation are described and their impact in evaluation theory and practice are addressed. Through this investigation knowledge about concept mapping applications will be generated and will provide a basis from which informed decisions about use can arise. This study will clarify when concept mapping methods will be most useful and productive in evaluation theory and practice. An understanding of which concept mapping approach might best be used in a given set of circumstances will be provided in this research.

Organization of the Thesis

The thesis is organized into chapters corresponding to the main components of the study. Each of these chapters is described in turn. **Chapter 1, Introduction** briefly identifies the problem to be investigated and structures the components that will be incorporated into this paper. **Chapter 2, Prior Literature** begins with a discussion of specific terminologies and definitions of concept mapping. In order to understand fundamental issues and dimensions of concept mapping, the chapter proceeds with an in-depth exploration of contributing theoretical perspectives. In particular, review of

theoretical articles and books, describe in detail the psychological, sociological and philosophical foundations from which concept mapping has evolved. These foundations are then linked to present uses in concept mapping and the variations of concept mapping applications are presented. Chapter 2 concludes with consideration of concept mapping relevance in evaluation and systematic inquiry followed by the presentation of specific research questions for the study.

Chapter 3, Methods, describes in detail how the present meta analytic study was conducted. Initially, the sampling criteria for study selection and methodological process undertaken are described. The readers is alerted to the main differences and modifications for the meta-analytic procedures applied. These are contrasted with the more quantitative approaches. To enhance further understanding, results are reported according to preparation, construction and interpretation phases of concept mapping applications.

Chapter 4, Results, presents the results of the meta analysis process. The results are presented in an order that corresponds to the main research questions presented in Chapter 2. This chapter makes extensive use of tables and displays of data to illustrate patterns that emerge.

Chapter 5, Discussion, emphasizes implications for concept mapping use in evaluation practice and theory. In this chapter, study contributions are summarized and limitations are noted. Subsequently, implications for future research in the area are provided.

CHAPTER 2: PRIOR LITERATURE

Concept Mapping Terminology

Over the years, various approaches to concept mapping have evolved as has the terminology associated with these methods for systematic inquiry. Early origins of concept mapping were referred to as "conceptualizations". In this regard, conceptualization refers to the process through which ideas and thoughts are articulated and represented in some objective form. In time, divergence of terminology progressed to reflect concept mapping methodologies and researcher preferences.

Despite the apparent diversion of terms that proceeded, the description of "conceptualization" accurately, but marginally, described the process that ensued. Early reference to "structured conceptualization," reflected the process through which ideas were represented in the form of a picture or map. Trochim coined the term "concept mapping" in an attempt to clarify this process. Unfortunately, this labelling led to further confusion with other methods of the same name and with methods having similar names. Examples included "mind mapping," "community mapping" and several other processes. "Mind mapping" refers to a process used in cognitive psychology to identify how thoughts are neurologically associated within the mind. "Community mapping" on the other hand is a process by which community assets are identified and mapped according to their geographical location within the community. These were confused with the concept mapping process researchers, like Trochim(1989), were attempting to clarify. Simultaneously, Miles and Khattri (1994) adopted the term "cognitive mapping" to reflect their conceptualization work. In this manner, cognitive

mapping also represented a conceptualization process in which concepts were visually represented by a map.

Although no single, clear definition of concept mapping exists, agreement over specific attributes and components of the process is evident. Specifically, concept mapping is a conceptualization process that allows for thoughts/ideas to be displayed in an organized fashion; a map. This system encourages and supports the development and understanding of relationships between concepts identified on the map. Broadly viewed, concept mapping is a structured conceptual process that enables the representation of a framework in a particular knowledge base to be visualized (Novak, 1990; Trochim, 1989). At the risk of oversimplifying the ongoing confusion, disagreement on terminology stems from the variation in how the process is applied not by what concept mapping actually is.

A considerable body of literature relevant to concept mapping theory is available. This literature is crucial in providing the base from which the evolution of concept mapping can be reflected. Underlying disciplinary foundations are critical for establishing the connections to present concept mapping processes. Exploration and understanding of these principles helps to situate the contextual nature in which concept mapping has developed.

In education, learning theories about how people came to develop, know things and see and do things differently, evolved from various foundations (Claxton, 1984). Early theorizing about how people develop their personal maps and how they come to know things provided a base model of learning theory. Over the past fifty years, the

basic model that generally viewed learning as a process through which the world we experience is manifested in our thoughts, expanded and broadened to include "associative learning" and "information processing" (Claxton, 1984). Acknowledging the need to identify how concepts were related and understanding how information is processed served as the foundation from which learning tools used in various educational settings were constructed.

Concept mapping technology became widely used as a learning and evaluation tool in education. It has been suggested to enrich teacher and student learning by allowing for the representation of conceptual relationships between ideas in a domain of knowledge (Anderson-Inman, 1997). Although science teachers predominated with concept mapping tools, use was expanded to other areas including language acquisition. Teachers employ concept mapping as a tool through which students are taught to identify and remember concepts, understand and link concepts, and visually represent these thoughts in an attempt to enhance their understanding of the specific area or phenomena being studied. Sufficient research over decades of use, has situated concept mapping as a manageable tool for helping teachers and students visualize and communicate information more explicitly. In evaluation, concept mapping has been used as an effective evaluation tool. Whether being used as an instructional tool or as a method for describing and understanding complex phenomena, principles of concept mapping can be traced back to psychological, sociological and philosophical foundations. Such tracings are the focus for the subsequent sections.

Foundations of Concept Mapping

Psychological Foundations

Work in cognitive theory by Ausubel (1968) played a key role in establishing the psychological foundations from which contemporary concept mapping theory and methods evolved. However, preliminary cognitive mapping theory development extends back several decades to work by Tolman (1948). Cognitive mapping was described as spacial knowledge or 'pictures in the head' by earlier theorists (Sholl, 1987). Like pictures, concept mapping today produces a visual representation of accessible information in a specific orientation. Spacial knowledge can be delineated as a sequential process to increase learning and integrate knowledge into general cognition (Chown, Kaplan & Kortenkamp, 1995).

Generally, theory in cognitive mapping emphasizes humans' systematic acquisition, storage, access and utilization of knowledge (Golledge, 1986). In schemata theory, discussed by Milligan (1979) and Sholl (1987), concept mapping processes directly parallel the schema system. Schema systems are active processes by which mental pictures or understanding of something learned is developed (Smilkstein, 1991). People acquire knowledge only to the degree by which they have constructed schemas from learning experiences. These schema systems are integral to the process by which configurations of new information are remembered in terms of a schema derived in conjunction with collections of previous thoughts. People classify new experiences into general classes and then specify the exceptions or existence of

any relationships these ideas may have to other classes within their schema (Milligan, 1979).

Similarly, concept mapping configures abstract thoughts into classes of systematically obtained representations. In cognitive mapping, these specialized structures are constrained by the capabilities of the human visual system. Particularly, information about concepts is picked up as a person scans the visual field (Sholl, 1987). Since a person's visual movements involve the acquisition of visual stimuli through a progressive step-like process, cognitive processes are often considered sequential. A person is thus able to represent visual knowledge experience and newly acquired stimuli sequentially into a simultaneous cognitive system. Heider (1958) and Osgood (1957) suggest that these cognitive systems are arranged systematically in the form of interrelated constructs which are relied upon to anticipate and classify knowledge, similar to what the concept mapping process attempts to do. These systems function to allow individuals to make linkages among concepts integrated into their general cognition (Chown et al., 1995). Later works in cognitive theory provide additional knowledge about how people manage the vastly complex tasks of achieving, retaining and transforming information into cognitive patterns. Bruner(1973) describes these processes as a sequence of decision-making events.

Concept mapping technologies are embedded in cognitive learning theory. In general, the acquisition and storage of knowledge delineated in cognitive learning theory directly parallels concept mapping steps defined by Trochim (1989). In learning theory, learners are stimulated to activate related knowledge in a particular area.

Similarly, participants in concept mapping processes are encouraged to access related knowledge on the area under focus during the brainstorming phase. Cognitive learning processes of guiding learners to develop new structures or knowledge about the structures is parallelled by the processes in concept mapping of generating and developing items and interconnections. Like cognitive learning theory, concept mapping processes consolidate new structures and knowledge. In cognitive learning theory under appropriate conditions, learners acquire a more unified, complex understanding of the phenomena in question. In concept mapping, the consolidation of information is demonstrated by the aggregation of information displayed using individual and group maps. These maps help participants develop broader, common understandings of the information displayed. Opportunity to encourage the creative use of this knowledge is of core significance in cognitive learning. Learners are encouraged to use this information in a way that makes sense to them. Similarly, concept mapping assimilates this use of information to explore the phenomena under focus. By interpreting the information individuals and/or groups are encouraged to explore, clarify, verify and apply the results derived from the actual maps generated. As in learning theory, this refinement of ideas simulates the opportunity for people to clarify and enrich the complexity of the knowledge acquired.

In summary, spacial knowledge principles support concept mapping processes in visual patterning and orientations. Concept mapping appears to utilize these basic principles by evoking visual representations of thoughts in a systematic, relational process. In adhering to the way people integrate concepts into cognition, concept

mapping manages to simplify the complex tasks of achieving, retaining, and transforming concepts through cognitive schematic work.

Sociological Foundations

While cognitive theory provides structure for the perceived acquisition and integration of knowledge, sociological principles provide processes for understanding the connections in terms of "social processing" (Garling, 1984). Theoretical work on concept mapping moved away from earlier emphasis on cognitive measurements required by cognitive theory to theoretical concerns involving the nature and structure of constructs within a socially interactive environment (Holahan, 1986). This perspective is consistent with Huberman and Cox (1990) who contend that the acquisition of knowledge is an interactive reciprocal process between and within individuals in the environment.

At first glance such considerations may appear frivolous in respect to concept mapping technology. However, these interactive networks are precisely the foundations in which concept mapping variations rely. That is to say, group and individual constructs are established during an interactive process in conjunction with individual experiences and strategies. Concept mapping relies heavily on these interactions in creating construct maps that reflect of these communications. Similarly, information becomes knowledge through an interactive process between people and their environment. This position is consistent with a long line of psycho-sociological research emphasizing the importance of socially constructed thoughts that make learning at both individual and group levels possible (Bandura, 1986).

In social processing, the acknowledgement and rationalization of thought construction is defined through the interactions of people. Variations in concept mapping applications, discussed later, adopt varying levels of social processing principles. Applications favouring emergent methodologies and less structured approaches directly embrace principles of social processing. These applications rely heavily on interactions between concept mapping participants and researchers throughout the process. Knowledge is constructed through an interactive link between people involved in the concept mapping process. Open discussions, interviews and focus groups generate the items to be used in the application. Similarly, ongoing communications between individuals is crucial during the construction and interpretation of the maps. In group concept mapping, people construct and understand the maps as networks among thoughts of individuals within groups. Individuals within groups are encouraged to share their knowledge and inevitably develop group constructs of knowledge on a particular area. In essence, the final group map is a visual representation and acknowledgement of thoughts constructed through social interactions between people.

In contrast, several concept mapping applications adopt less socially interactive processes. These applications rely heavily on statistical analysis and interpretation of data. Despite the minimal emphasis given to social processing in these approaches, interactions of participants are still a vital component of concept mapping. In general, all concept mapping applications require participants to generate items. These people are involved in an interactive process with others undergoing the same concept

mapping process. Basically, all concept mapping applications rely on social processing. Some applications integrate these principles throughout the process while others maintain less socially interactive processes as concept mapping applications are implemented.

Philosophical Foundations

As in other research, concept mapping processes can be situated in a variety of epistemological stances. Traditionally, cognitive theory relied heavily on scientific inquiry and was emersed in decidedly positivistic or logical empiricist approaches and principles. Positivism was associated with objective realities that could be investigated through experimental methods (Lincoln & Guba, 1990). Positivist epistemology viewed knowledge as that which had been proven, confirmed and acquired through concrete evidence. This stance allowed the social sciences to simulate the apparent objectivity assigned to the natural sciences (Robertson, 1994).

Historically, at least, interpretivist epistemology arose from the critiques of positivism in the social sciences. Specifically, interpretivists disagreed with social science attempts to import standards and procedures of the natural sciences in order to study human beings in society (Schwandt, 1994). Arguably, interpretivists, held that cultural sciences differed from the natural sciences and should thus be studied to gain understanding of social phenomena rather than scientific explanations associated with the physical sciences.

Philosophically, interpretivist researchers construe meaning as the primary focus in exploring the nature of social reality. "Facts" are not entities waiting to be discovered

in the natural, objective world. Instead, they are social constructions of the ways human beings experience actions through interpretive activities (Ferguson, 1993). Concept mapping methodological techniques and strategies fit with the tenets of interpretivism established here. Since qualitative methods are often associated with interpretivist research, concept mapping approaches that reflect these structures support the interpretivist paradigm most effectively.

While interpretivists emphasized the world of experience as it is lived, felt and undergone through social interactions, constructivists stressed the construction of knowledge (Schwandt, 1994). As concept mapping evolved over the decades more adherence to sociological principles surfaced and variations in concept mapping procedures continued to emerge. Constructivist inquiries adhered to more interactive approaches and value-laden perspectives that sought to construct social knowledge. At the risk of oversimplifying, constructivists assume that the terms by which the world can be understood is predicated by social interchanges among people. Realities and therefore knowledge is constructed as the result of social processes accepted in a specific context within a particular community. Variations in concept mapping approaches that surfaced in constructivist inquiries, adhered to these more adaptive, social functions of cognition. More interactive processes with individuals and groups were evidenced in these concept mapping applications. Maps constructed about a particular phenomena resulted from the direct interactions of people within the group.

While concept mapping as a tool tends to be used in ways consistent with interpretivist and constructivist paradigms, as a methodology it is free of ties to any

particular philosophical orientation to knowledge and ways of knowing. In this respect, it is similar to several so called qualitative methodologies that could be applied in a decidedly preordinate (Miles & Huberman, 1994) or emergent (Lincoln & Guba, 1990) ways. On the one hand, a conceptual framework might be constructed and used as a standard to which subsequently constructed cognitive maps could be compared. Such an application would be consistent with revised positivistic perspectives that seek to elicit more personal understanding of knowledge. The conceptual framework provides a basis or standard from which subsequent maps can be understood and compared. On the other hand, concept mapping could be used to locally construct a shared interpretation of phenomena of interest (MacDonald, Cousins, Bailetti, & Rahman, 1996; Sholl, 1987). Such applications would be consistent with more interpretivist perspectives. In these applications, knowledge acquired is dependent on the social and cognitive construction of meaning by the individuals within the group (Cousins & Simon, 1996). The interpretivist assumption that no particular explanation can be more valid than any other supports the development of knowledge that fosters understanding and truly creates a shared interpretation of the area under focus. Constructivist applications of concept mapping involve the notion that the mind is an active creator and manipulator of symbols that support the development and understanding of knowledge. As such, people involved in the concept mapping process, brainstorm ideas about a specific domain of knowledge leading to the development of representative maps that clarify and foster understanding of the complex structures under exploration. In the constructivist paradigm, concept mapping

is considered a process that supports and creates a learning environment that enhances the process of knowledge construction and increases the understanding of phenomena.

From yet another epistemological perspective, concept mapping might also be employed as a critical theoretic tool as an aid to encourage participants to gain a deeper understanding of their circumstances thereby fostering self-determination and responsibility. Such approaches would likely be highly participatory and engaging for participants (Fetterman, 1994). As a critical tool, participants commit to social justice principles that are inevitably value centred. Critical theory is best understood in the context of empowerment of individuals. As such, critical inquiries aspire to confront the injustice of a particular society or situation within society (Lather, 1992). In these approaches, knowledge is an artifact of culture, inseparable from the persons' knowledge systems and structures and highly influenced by those using it. Critical research supports political actions that can be taken to address the injustices found within the context of the research (Kincheloe & McLaren, 1994). Within these assumptions and applications, concept mapping can be used as a tool to shape knowledge in an emancipatory context.

Interpretivist, constructivist and critical theory research paradigms are the underpinnings from which variations in concept mapping applications surface. Interpretivist and constructivist approaches adopt concept mapping applications that support interactions amongst people in developing information about specific phenomena. Critical theory research supports concept mapping processes that favour

political examination and action on injustices within the context of the research undertaken. Despite epistemological differences, concept mapping applications are flexible and adaptable processes. However, the concept mapping applications employed in a study are dependent on the epistemological and methodological orientation adopted by the researcher. Specifically, the underlying paradigm that researchers bring to the inquiry process guides which concept mapping approach will be adopted. The epistemological perspective adopted in a study, is critical to understanding the nature by which various concept mapping approaches are applied. It is precisely these evolving perspectives that establish the basis from which contributions to evaluation theory can be elicited.

In summary, an understanding of the psychological, sociological and philosophical foundations from which the concept mapping process is derived, are crucial. Psychologically, concept mapping in all approaches manages to simplify the complex tasks of achieving, retaining, and transforming concepts through cognitive schematic work that integrates concepts into cognition. While psychological foundations emphasize cognitive structures associated with concept mapping, sociological foundations stress social interactions as integral to concept mapping evolution. Sociologically, all concept mapping approaches adopt varying degrees of social, interactive processes. Despite minimal emphasis given to social processing in approaches that emphasize statistical analysis, social interactions of participants are still vital components of these inquiries. All concept mapping applications rely on these interactions, however, the degree to which these social processes predominate

varies across applications. Philosophically, on the other hand, concept mapping applications are consistent with varying epistemological research paradigms. These epistemological perspectives underly the nature of the concept mapping application employed by the researcher. As a methodology however, concept mapping is free of ties to any particular orientation to ways of knowing and is operative in both qualitative and quantitative venues.

These psychological, sociological and philosophical foundations clarify and construct the framework from which concept mapping has evolved. It is precisely these evolving perspectives that establish the basis from which contributions to evaluation theory and practice can be elicited. Over the years, the evolution of psychological, sociological and philosophical foundations led to the creation of various concept mapping applications. Such applications are described in the ensuing section.

Concept Mapping Variations

Current research suggests that concept mapping applications are highly varied. The evolution of concept mapping over the past few decades can be attributed to recent work undertaken by several researchers. William Trochim and associates at Cornell University have developed distinct concept mapping methods. Similarly, cognitive mapping methods developed by Miles and Khattri (1994) and adapted by others --for example, King, Louis, Allen, and Weiss (1995) --provide alternative distinct approaches and applications. Variations in method and approach are explicated below.

"Structured" Approach

The scholarship of Golledge (1986), Novak (1990), Smith (1992), Trochim (1986, 1989, 1995) and several others utilize a systematic, structured approach to concept mapping process in research. Generally, researchers using this approach view concept mapping as a structured conceptualization that can be described by a sequence of concrete, operationally-defined steps which yield conceptual representations.

Trochim and colleagues describe this sequence of events through a six step process in which ideas are represented in the form of a picture or map (Trochim, 1989). This six step process can be guided by a facilitator who could be an external or an internal member of the group using the conceptualization process. Figure 1 displays the six step process listing pertinent tasks achieved in each step.

In "preparation" the first step, the facilitator works with the group to determine who will participate in the process. With the participants, the focus for the phenomena under investigation is created. Participants must then define the focus for the brainstorming session and develop the focus for ratings. The brainstorming focus involves defining specific aspects of the domain under exploration. For example, concept mapping processes in program evaluations might involve targeting the nature of the program, outcomes and measures. The rating is defined by identifying the dimension(s) in which each of the brainstormed statements will be rated (Trochim, 1989).

In step two, the actual concept mapping process begins with the generation of statements. Participants are prompted to generate statements about the area under inquiry. During brainstorming, discussion about validity of statements is not encouraged, however, clarification of unfamiliar terminology and context is promoted to ensure common understanding of what is intended by a particular phrase. Redundancies are eliminated and a final set of statements is generated. During this step, participants generate through brainstorming in a particular area of focus, a series of statements which are captured, refined and prepared for further analysis by the facilitator(s).

These facilitator-derived statements are then structured through individual systematic sorting and importance rating tasks in the third step. Specifically, individuals are encouraged to systematically sort the statements into piles that make sense to them. During this procedure, statements can only be placed in one pile at a time. However, statements should not all be placed into a single pile nor should all statements be placed into separate individual piles. Upon completion of sorting, participants rate each statement according to level of importance as defined by the initial focus statements.

In the fourth consecutive step, the sorted statements are subjected to statistical analysis using multidimensional scaling and cluster analysis techniques. Both techniques rely heavily on quantitative analysis to cluster similar items and situate them according to statistical similarities. Initially, the analysis locates each statement as a

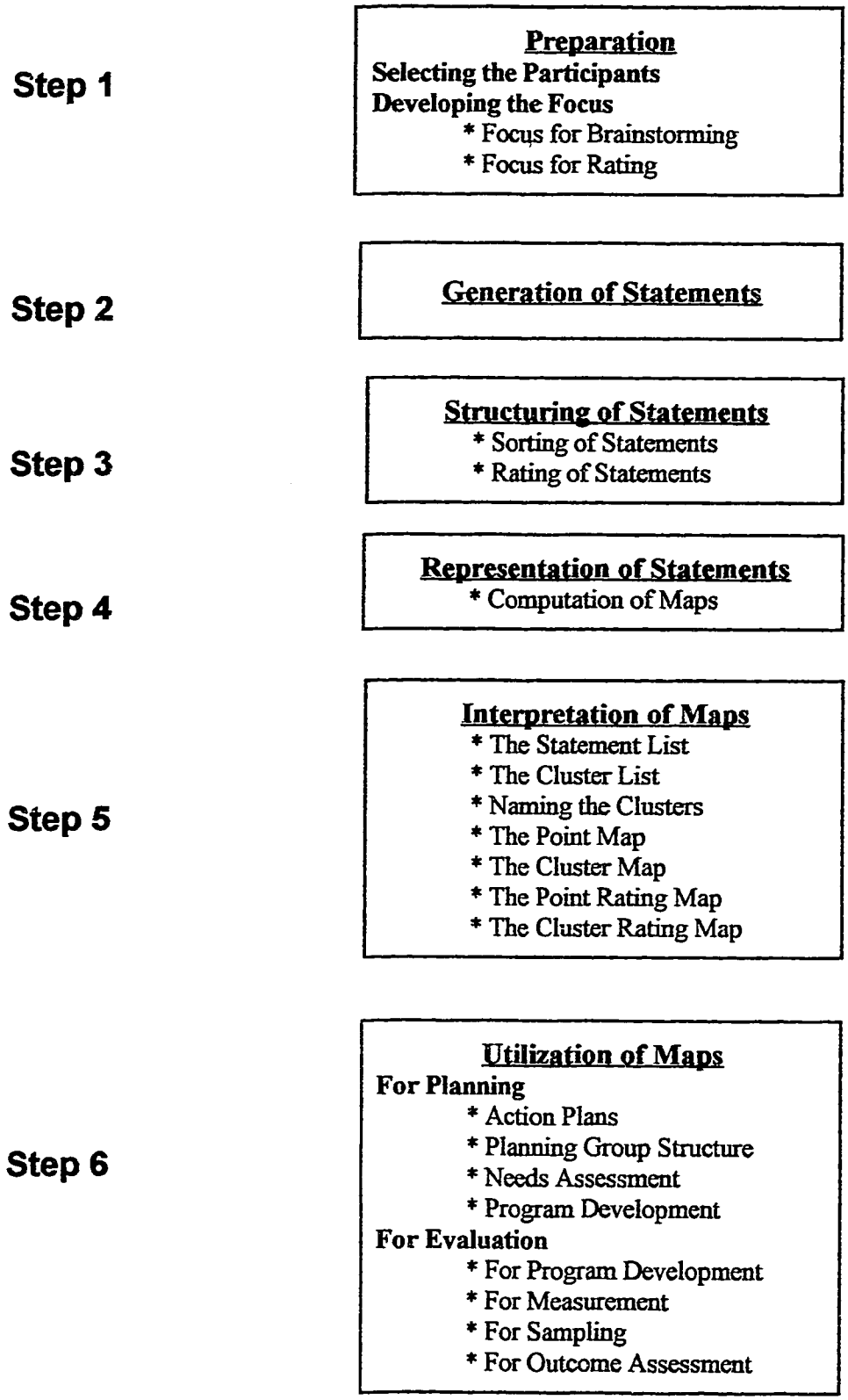

Figure 1.Trochim's 6 Step Concept Mapping Process Note. From "An Introduction to Concept Mapping for Planning and Evaluation," by William, Trochim, 1989, Evaluation and Program Planning, 12(1) p. 3.

separate point on a map with similar statements in closer proximity. Partitioning of similar statements into clusters is proceeded by the construction of maps. Trochim's software program Concept Systems permits cluster maps to be presented in a variety of ways by integrating importance rating data and allowing for variation in key parameters such as number of clusters.

Interpretation of the maps is undertaken during the fifth step of the conceptualization process. This crucial step relies heavily on the material and products generated in the previous steps. The original list of brainstormed statements is provided as a reference point for participants. Cluster maps and lists of statements ordered by clusters are used by participants to name or describe each cluster of statements. Cluster labelling is normally accomplished by various facilitator-driven techniques. The participant group is also provided with a 'point map', a result of the multidimensional scaling technique, displaying the relative location of each of the statements (Optionally, importance ratings for each statement can be displayed). Distinct regions on the cluster maps are identified and a final cluster map with relevant labels is produced. Participants are encouraged to discuss this final map until it makes sense for them and for the process at hand.

The sixth and final step in Trochim's process involves the utilization of the final maps. These maps are used to discuss the original purpose for conducting the structured conceptualization. Specifically, use of maps is determined by the original reference point from which the concept mapping process was undertaken. Maps can be used as a tool for framing or guiding the research process in a particular field. In

evaluation contexts for example, the maps could be used to plan, organize or implement a program depending on the particular area under focus.

This systematic, operationally defined approach relies heavily on statistical techniques using multidimensional scaling and cluster analysis to generate the maps. Several computer programs are now available to support this process including Cope, Concept Systems and others. Cope is a software program developed to operate "cognitive mapping" techniques for qualitative data representations and analysis (Cropper et al., 1990). Concept Systems, developed by Trochim and colleagues, is a windows based software program that directly supports and implements all techniques described in the six step concept mapping process. Trochim and MacLinden (1995), have continued to expand this software program to guide and support all functions of the process. Specifically, developments have allowed for online access to the system through use of network databases. Individuals can participate in the concept mapping process through site links from various locations. Brainstorming, sorting and ranking and all other phases can be directly completed online for the process. Generally, this approach favours group measurement analysis rather than more qualitatively framed approaches followed by other researchers. It is important to note that while this approach is highly quantitative and measurement-oriented, significant opportunities for interpretation and subjective input are required, especially at cluster naming and utilization phases. Such subjectivism, parallels that found in other quantitative and statistical applications such as exploratory factor analysis. Multivariate data reduction

techniques of this sort tend to imply a level of objectivity in measurement that exceeds what would be permitted by the decidedly subjective and interpretative components.

"Strategic/Emergent" Approach

In contrast, Miles and Khattri (1994) have developed a less structured cognitive mapping process in their research. Concept mapping is viewed as a graphical technique for understanding thoughts and perceptions and how they might be interrelated (Khattri, 1995). These cognitive maps provide a basis from which information can rapidly, more intuitively, be drawn (Miles, 1991). Overall, the concept mapping process followed by these researchers is guided by more subjective qualitative techniques clearly distinguishing it from more quantitatively driven approaches.

In current research utilizing the "Strategic/Emergent"Approach (e.g., King et al., 1995), one-on-one interviews, focus groups, and open-ended questionnaires are used to generate ideas in a particular focus area. In this approach, researchers tend to facilitate the process using participatory, qualitative methods. In general, the statements generated are transcribed onto "post-it" notes or cards by the researchers or the participants themselves. Participants are then responsible for arranging the ideas individually on large sheets of cardboard, for example, in ways that show how they think about particular ideas and why (Miles & Huberman, 1994). Individual participants connect and link concepts in such a way that makes sense to them and are encouraged to discuss and describe these connections.

As research progresses, ongoing individual interpretations of the displays are provided by the participants. Researchers may facilitate the discussion with individual participants using one-on-one interviews and open ended questions. These discussions with participants are usually audio taped records obtained during the analysis. Researchers then listen to and use these tapes of the cognitive map generating sessions as a basis for preparing descriptive text that represents the complete map. This information in conjunction with the completed maps are brought back to the participants for clarification, validation and representation of accuracy. Clarifications and any necessitated modifications are made with the participants.

Further analysis by the researcher then takes on the form of noting patterns and themes across individual maps and interpretations. By acknowledging similarities and differences in patterns, researchers develop conclusions about the phenomenon in question (i.e., focus area). This descriptive text can then be returned to individual participants for further comments and suggestions. Upon completion of any final modifications, knowledge about the specific focus area is refined and presented.

Cognitive mapping processes in this approach rely heavily on qualitative data collection techniques. Several computer programs using hypertext features such as HyperRESEARCH, ATLAS/li, and Metamorph permit linking among various categories and are particularly useful in supporting the "Strategic/Emergent" Approach strategies for concept mapping (Weitzman, 1994). Generally, the "Strategic/Emergent" Approach favours more emergent strategies rather than the quantitative measures used by other researchers.

Other Variations

Variations of both approaches are prevalent in current research using concept mapping. Researchers in business, education, evaluation, health, medicine, psychology and the social sciences use cognitive mapping processes in a variety of ways. Several applications tend to fall somewhere between the "structured" and "strategic/emergent" approaches and represent points at opposite ends of a continuum of application. In Morine-Dershimer's (1991) version, researchers place a specific area of focus in the center of a board. Participants are then encouraged to generate a list of concepts on the particular domain of knowledge and place the generated concepts around the area of focus with unnamed links. Similar, to the "Structured" Approach, these constructed maps are then analysed by the researchers however, methods used for analysis are more consistent with those used in the "Strategic/Emergent" Approach. McKeown and Beck (1990) derive the production of cognitive maps from particular texts of knowledge, utilizing a step process adapted to literature as opposed to actual participants. Similar to the "Structured" Approach, operationally defined steps are undertaken to produce conceptual maps on the area of focus. In contrast, however, ideas are derived through literature instead of brainstorming techniques used with participants in the "Structured" Approach. Other researchers, such as Cousins and MacDonald (in press) have modified existing approaches to conduct their investigations. As in the "Structured" Approach, Cousins and MacDonald (in press), invoked multidimensional scaling procedures to construct the maps however, similar to the "Strategic/Emergent" Approach, a collaborative research team, comprised of trained

researchers from different disciplines and individuals responsible for the development and implementation of management training interpreted the cluster solutions and derived the conceptual framework. This team had previously developed a set of statements from interview data collected from managers.

Research using these variations use a range of strategies encompassing both quantitative and qualitative measures. Researchers tending to favour more quantitative techniques use concept mapping applications aligned more closely to those described by the "Structured" Approach. On the other hand, studies adopting more qualitative measures follow concept mapping processes most similar to those defined by the "Strategic/Emergent" Approach. Others, adopt a combination of strategies from both approaches and inevitably present a complementary approach to concept mapping. This eclectic approach to concept mapping applications is evident in evaluation research.

The focus for the present research is the use of concept mapping applications within the context of evaluation and systematic inquiry. We now turn to a review of the conceptual perspectives in this domain. In particular, a conceptual framework is developed in order to help situate concept mapping applications.

Evaluation and Systematic Inquiry

Evaluation is a process by which information is gathered in order to make decisions regarding a particular area of focus. In these evaluation contexts, various concept mapping approaches have been applied and appear throughout the literature. In several instances, for example, concept mapping has been utilized to conceptualize

a particular area under focus. In the case of planning, concept mapping has been used to define, organize, operationalize, implement and evaluate aspects of programs. Similarly, concept mapping has been used to develop conceptual frameworks from which evaluations and systematic inquiries are constructed. In this respect, systematic inquiries refer to empirical research on evaluation. Current research in evaluation demonstrates an increase of concept mapping use in both formative and summative evaluations.

Evaluation Purposes

The process of fully developing evaluation theory is embedded in the changing views and influences offered by many evaluation theorists (Alkin, 1991). Alkin (1991), explicates the following four preliminary assumptions about evaluation:

1. Evaluation is a process of gathering information.
2. The information collected in an evaluation will be used mainly to make decisions about alternative courses of action.
3. Evaluation information should be presented to the decision maker in a form that can be used effectively.
4. Different kinds of decisions require different kinds of evaluation procedures.

Derived from these assumptions and their inherent caveats, evaluation is defined as a systematic process of, selecting, collecting and analysing information in order to report summary data (Alkin, 1991). Alkin (1991) suggests that these data are useful for decision makers to assist them in selecting among the choices on hand. Further classification by Alkin (1991) situates evaluation into two categories: judgement-

oriented (summative) and improvement-oriented (formative) evaluations. Judgement-based evaluations guide decision-making processes based on merit and worth. Through identification of a program's merit and worth, decision-makers can choose to sustain (merit and worth are high; program goals and objectives are met) or terminate (program is deemed to have little merit and worth; goals and objectives are not being met) the program. Improvement-oriented evaluations on the other hand, support processes that strive for improvement. In improvement-oriented evaluations, ongoing modifications for program enhancement are made based on the information provided throughout the evaluation process. Scriven (1996) supports the use of a formative/summative dichotomy to classify evaluations. Patton (1997), on the other hand, suggests as a third additional purpose for evaluation, to go beyond the formative/summative dichotomy and create new knowledge through evaluation. Such would be the case, for example, in large multi-site evaluation projects that would lend themselves to the generalizability of findings.

In commenting on summative program evaluations, Stufflebeam (1994) and the Joint Committee on Standards for Educational Evaluation, maintain that evaluation is a rigidly defined process that adjudicates merit and worth to the area under investigation. This systematic, judgmental view of evaluation is consistent with Scriven's (1991) view. In evaluation, merit is measured against professional standards and/or criteria set forth in the area under exploration (Scriven, 1995). Worth, on the other hand, is weighted by the extent to which a program meets institutional and societal needs. Societal

needs can best be viewed as the legitimizing, politically inspired value given to the focus of the evaluation in the context in which it was intended.

On the other hand, formative evaluations, are intended by the evaluator as a basis for program improvement. Many authors (e.g., Cousins & Earl, 1995; Fetterman, 1995; Patton, 1997), subscribe to this broader definition of evaluation that fosters development and improvement-oriented modalities of systematic inquiry. Formative evaluations are intended to foster the improvement of the entity under evaluation without necessarily rendering judgements about its overall merit and worth. Such evaluations are in contrast to but not completely independent from summative evaluations that are intrinsically decision-based and grounded in considerations of merit and worth. Ultimately, Scriven (1996) cautions that the formative versus summative distinction is contextually dependent. Information about a particular program obtained for a summative evaluation can be made formative by changing the context in how the information is used. Specifically, the same information can be used as a basis for improving the program. As a result, classification of an evaluation into this dichotomy is inevitably context bound and when viewed as such can be quite valuable.

Evaluation Processes

Evaluation researchers tend to favour various intrinsic principles and strategies inherent to evaluation processes. One way to explore these processes is by using a metaphor used by Scriven (1996). He describes evaluation processes through use of "black box", "grey box" and "glass box" analogies.

Evaluation processes entrenched in principles of traditional, behaviourist research in the social sciences assimilate a "black box" approach. These processes tend to ignore cognitive processes while emphasizing or focusing on the observable effects of inputs (Robertson, 1994). Outcome-oriented, quasi-experimental, comparative evaluations provide the example. These comparative methods assist in reducing threats to internal validity and thus support conclusions about, for example, the extent to which a program achieves its objectives. While seeking evidence of program impact rather than identifying what happens within the program, "black box" evaluations produce outcome based results (Cook, 1990; Scheirer, 1994). Routine measurement of interpretive, subjective, non-process data and reporting of indicators are common monitoring processes used in such evaluations (Affholter, 1994).

While "black box" evaluations emphasize input and output data, "glass box" evaluations are framed by elaborate conceptions of program theory. As a structured technology, program components and outcomes are systematically linked and evaluated. These non-comparative evaluations attempt to conceptualize and explicate the various program components under investigation. Program resources, intended outcomes and specified linkages between the components, outcomes and delivery are identified (Chen, 1990). As an extension of impact evaluations, program theory in "glass box" evaluations helps reveal the realities of all aspects of the program. Bickman (1987) casts program theoretic approaches to evaluation, as a model that constructs that is driven by a defensible conception of how a program is supposed to work.

In contrast, "grey box" evaluations focus on verifying what the program is and whether or not it is delivered as intended (Scheirer, 1994). In essence, "grey box" evaluations attempt to examine in a less intricate way the impact of underlying program theory used in "glass box" evaluations (Scheirer, 1994). Such evaluations are often called process evaluations. The central task is to explore the effects of program's intentions and the overall processes that have been undertaken to mount the program. While process evaluations do not require the intricate conceptualization of program theoretic approaches, they do focus on the link between program processes and effects.

In summary, "black box" evaluations provide outcome results based on input and output data available. "Glass box" evaluations, on the other hand, investigate various components of the program to develop information about the program and "grey box" evaluations investigate the effects of program components in a less intricate way.

Evaluation Consequences

Traditionally, the utilization of evaluation data has been defined as the instrumental (support for discrete decisions and conceptual educative function) use of evaluation findings (Cousins & Leithwood, 1986). The extent to which evaluators are accountable for the use of evaluation data has been subject of intense debate. Notably, the "Weiss-Patton debate" (Patton, 1988; Weiss, 1988), suggested the need for contextual recognition between policy and program venues in evaluation. Specifically, Weiss argued that an evaluator should strive to ensure findings are accurate and adequate to represent the evaluation. On the other hand, Patton, suggested that the

evaluator expand these responsibilities to support decision makers identifying needs, determining what should be addressed and generating findings required by the intended user. In essence, theorists and researchers continue to explicate context and process through empirical works.

More recently, evaluation consequences have been conceived in terms of "process use" or the impact of the actual process of doing the evaluation. (Cousins, Donohue & Bloom, 1996; Patton, 1997; Shulha & Cousins, 1997). From this perspective, collaborative and participatory forms of evaluation are more likely to have observable consequences by virtue of their involvement of key stakeholders in the process.

Consistent with the conceptions of process use, evaluation impact and utilization is thought to extend beyond the entity being evaluated (Cousins & Earl, 1992; Huberman & Cox, 1990; Jenlink, 1994; Mathison, 1994). One way to conceive this broader impact is to consider organizational consequences. Organizational learning is a theoretical process that assumes that knowledge is socially constructed (Bandura, 1986). Central to this perspective is the proposition that shared images of reality and symbolic systems are useful in generating this learning. The development of a shared, common mental understanding of an organization and its operations by members is fundamental to organizational learning.

As a socially constructed process in utilization and dissemination, evaluation can be viewed as a potential organizational learning system. A significant body of research has demonstrated sufficient links between evaluation activities and the

development of organizational capacity (Cousins & Earl, 1995). For example, stakeholders can be directly involved in all aspects of the evaluation and inevitably foster utilization. In these cases, responsiveness to organizational needs is imminent. In recent times, interest in this aspect of broadened evaluation use appears to be expanding (Shulha & Cousins, 1997).

Concept Mapping in Evaluation

Concept mapping approaches as a set of methodological activities are consistent with and applicable to the different kinds of problems confronted by evaluators. Similarly, the contextually determined information obtained through concept mapping process is relevant to Scriven's formative and summative dichotomy. Concept mapping processes have been used to adjudicate merit and worth of evaluation entities in certain situations while fostering improvement-oriented systems in evaluation in others.

Concept mapping technologies can be used to support both outcome and process evaluations. Specifically, concept mapping can be employed as an efficient mechanism for measuring and monitoring outcomes in "black box" evaluations. On the other hand, concept mapping technologies can help to effectively explore program components and attributes as well as the effects of intentions and processes in "glass box" and "grey box" evaluations. In general, concept mapping is a highly applicable methodological tool for evaluation contexts.

Consistent with expanding views of evaluation consequences concept mapping approaches appear to be consistent with the recently developed more broadened

perspectives. Considered in this way, these concept mapping approaches support a system by which groups frame and visually represent thoughts about a particular phenomenon. Such "social processing" helps users develop shared understanding of phenomena and in turn facilitates the development of interpersonal networks and forums for dialogue and exchange. This process naturally lends itself to the development of organizational learning.

As promising, in the evaluation domain, as the concept mapping process may seem, claims related to concept mapping contributions to evaluation theory and practice have not yet been fully explored. Potential uses and exploration of the various concept mapping applications are not explicit in the research. However, sufficient empirical research using concept mapping in evaluation has accumulated to warrant a review of this body of knowledge and synthesis. In turn, this aggregation of knowledge about concept mapping can establish a foundation from which informed decisions on use, application and contributions can be established.

Specific Research Questions

Research using concept mapping continues to proliferate in evaluation within a wide range of disciplines and domains of inquiry. Many claims about concept mapping applications and consequences in relation to evaluation practice and theory are surfacing and to a lesser degree empirical research using concept mapping in evaluation is accumulating. Over the past fifteen years, an abundance of this empirical research has proliferated. While variations in approach have provided a wide range of concept mapping applications, direct considerations of concept mapping

contributions to evaluation have been minimal to date. Using non-traditional, meta-analytic techniques on the extent of empirical research, concept mapping contributions to evaluation practice and theory can be extracted. The present study provides a synthesis of this information using current, original empirical studies. Knowledge about concept mapping applications will be generated and used to provide a basis from which informed decisions about use can be made.

The study explores central questions that target concept mapping contributions in evaluation. Specifically, the study is guided by the following sets of questions:

1. For what purposes has concept mapping been used in evaluation practice in general?

2. Has concept mapping contributed to the development of evaluation theory? If so, how?

3. To what extent do applications of concept mapping in evaluation practice vary across studies? What are the important dimensions that emerge?

4. Do the dimensions vary across domains of inquiry? In particular, are applications in educational evaluation different than those in other areas? If so how?

5. Are dimensions of concept mapping processes associated with observed evaluation purposes? If so, how?

CHAPTER 3: METHODS

In an attempt to explore potential contributions, empirical research in evaluation using concept mapping formed the data set for this study. Initially, studies were screened for qualifying characteristics and criteria. Inquiries meeting the established requirements were then subjected to an intense, non-traditional, meta-analytic procedure with respect to concept mapping methodology and applications. Each process is discussed in the following sections.

Sample

Studies were selected for the present research according to the following criteria. They: (a) report the collection of original data(empirical); (b) provide an explicit link to evaluation theory and/or practice broadly defined (e.g., management evaluation; program planning and implementation; organizational, personnel, policy, product, program, and student evaluation); (c) are published in a peer-reviewed or refereed forum and/or by researchers with an established track record; and (d) are published within the past 15 years. Peer-reviewed journals, articles and books, dissertations and masters theses are all considered to be refereed documents. For documents falling outside of these forums (e.g., non-peer reviewed books, chapters in books, conference papers), author credibility was established with the aid of the Social Science Citation Index (SSCI). While SSCI norms are unavailable, a recent study of Canadian federal social sciences strategic grant recipients by Cousins, Simon et al. (1993) revealed that a median of one citation per year in the past five years reflected the productivity for this successful group. This rate of productivity is used as a point of reference in the

present study. That is, authors with one citation per year for the past five years are considered to have an established track record; and finally, (e) selected studies utilize concept mapping technology as a primary method in the research.

Studies were located using Dissertations Abstracts International (DAI), Educational Resources Information Centre (ERIC), Psychological Abstracts (PSYCHINFO), Sociological Abstracts (SOCIOFILE) and Wilson's Business Index. In conjunction with these data bases, INTERNET research news groups were accessed for relevant studies and information. In addition to database searches, a small sample of investigators using concept mapping or developing concept mapping applications was personally contacted for leads to relevant documents. Finally, bibliographic follow-up techniques were used.

The selection procedures resulted in the selection of 33 empirical studies in evaluation theory and/or evaluation practice that have been reported over the past fifteen years. Studies were conducted in a wide variety of settings including secondary schools, universities, health organizations, business organizations, community-based agencies and research laboratories in North America and abroad. Thirty-six percent of the studies were conducted in the field of education, while 18% resulted from work in social sciences and 15% of the studies were undertaken in each of social services, health and business/organizations, respectively. An eclectic combination of quantitative and qualitative concept mapping techniques are demonstrated across the studies.

Procedure

Given the wide variation in research methods evidenced in the studies, an innovative meta-analytic technique was implemented. Such techniques have been employed in prior reviews by Cousins and associates (Cousins, 1996; Cousins & Earl, 1992; Cousins & Leithwood, 1986) and others (e.g., Leithwood & Montgomery, 1982; Ross, in press). Each selected study was coded using the preliminary screening device (see Appendix B). This initial coding system corresponds to the criteria established for the selection, as well as a more in-depth analysis of each study. The coding system was entered into a customized database system that allowed for in-depth exploration of the information.*

Bias in coding empirical studies was likely to materialize through a number of sources (Westbrook, 1990). In order to minimize any researcher bias in coding the studies, in addition to the rigorous selection criteria imposed, ten percent of the sample was randomly selected and independently coded by a second researcher. This researcher utilized the initial screening tools to code each study. Through formal discussions between the researchers, coding results were compared and minor revisions of tools were made.

The research questions provide the basis from which the data is analysed and displayed. Issues raised by each question are investigated and presented in turn. Initially, tables displaying descriptive characteristics and other pertinent information

*Note: The customized database system was designed using Microsoft Access and Visual Basic.

(i.e., authors/year, domain of inquiry, N, sample, context, design and theory) were produced using the individual coded sheets. These tables are presented with a brief description of each category and provide the base from which contributions to theory are explored.

Further identification of recurring themes and issues across the studies through intense examination provided the basis from which analysis occurred. Significant dimensions of application across the studies emerged throughout the investigation. Using systematic display techniques, examples of which were developed by Cousins and Leithwood(1986) and Conner (1979) tables were developed to explore these dimensions/issues. Specifically, studies were presented by dimension using the identifying number assigned in the initial descriptive table. In this manner, each study as well as potential patterns could be identified on visual examination of the tables. Upon further examination of the tables for similarities, differences and patterns, an accumulation of knowledge about concept mapping was produced. This information established the base from which the research questions were examined.

CHAPTER 4: RESULTS

An in-depth examination of the studies in evaluation led to a substantial amount of information regarding concept mapping use, application and nature. Using systematic displays concept mapping information is explored with relevance to evaluation practice and theory. Each research question is explored and discussed in the following sections.

Description of the Data Base

The 33 studies included in this research were categorized according to descriptive characteristics shown in Table 1. This Table displays each study along with an identification number (alphabetically ordered by the first author's last name). Studies were implemented in a wide range of disciplines including business/organizations, education, health, social sciences and social services. Sample sizes varied across the studies (from 3 to 83) with units of analysis ranging from individuals to groups of stakeholders associated with the evaluation. Links to evaluation practice are identified for each study under description of issues and context in Table 1.

The studies employed a variety of research designs utilizing concept mapping as the primary research methodology. Longitudinal studies investigated data gathered over a period of time during, and/or after an evaluation had been implemented. Evaluation results in some studies were limited as a result of insufficient time to adequately determine the impact of the results. Simulation studies involved evaluations conducted in highly controlled conditions. Retrospective studies relied on

data generated in previous evaluations and/or data collected from stakeholders. These studies relied on the memories of the individuals providing data.

The studies employed a range of theoretical orientations to the research. Elements of organizational learning theory, outcome monitoring approaches, process evaluation and program theoretic approaches to evaluate were evident in the sample.

Table 1: Concept Mapping Empirical Studies by Descriptive Characteristics

Id.	Author/Year	Domain of Inquiry	Sample Size N	Sample	Description of Issues and Context	Design	Theory
1.	Beyerbach & Smith (1990)	education	17	Female early childhood education majors in senior year of study.	Assess needs of preservice teachers. Teachers have difficulty using inquiry-oriented approaches. Need to generate and refine concepts of effective teaching in order to promote them.	Longitudinal	Program Theory
2.	Beyerbach, 1988	education	52	Undergraduate students in three-level Syracuse University preservice teacher education program	Assess adequacy of teaching particular concepts. Teacher education needs to develop concepts relevant to teaching and to develop technical shared vocabulary and a language for communicating about processes. Need for language and concepts that realistically represent classroom practice. Need to assess whether adequate teaching of concepts can lead to shared technical vocabulary. Need to understand relationships among key concepts. These could move the practice and theory of education further.	Longitudinal	Program Theory
3.	Caracelli (1989)	social science	70	Women enroled in university Excel Program	Assess experience of women reentering educational system to note any psychological changes occurring in their lives from entry to after first year. Investigation into transition to adults (motivation, expectations...)	Longitudinal	Program Theory
4.	Cohen Gold (1984)	education	not indicated	Illiterate youth and adults in university	Evaluate reading skills of illiterate youth. Need to improve skills of poor readers , illiterate youths and adults by increasing comprehension and helping to establish interrelated ideas	Retrospective	Process Evaluation
5.	Cooksy (1989)	social science	3	Theoretical models of validity	Examine resulting concept maps to compare to models. Explore possibilities of developing models which allow translation from one model to another and exploration of potential threats to validity	Simulation	Validity Issues
6	Cousins & MacDonald (1995)	business/organization	10 and 9	10 managers from 9 technology-intensive firms in Central Canada. 9 clusters of sorting data.	Need to develop a model for product development projects' success and assess and evaluate manager training in future through instrument developments.	Retrospective	Organizational Learning

Id.	Author/Year	Domain of Inquiry	Sample Size N	Sample	Description of Issues and Context	Design	Theory
7	Daughtry & Kunkel (1993)	social science	78	Undergraduate students in Introductory Psychology class	Assess elements of depression. Investigate scope and interrelationships among elements of depression experienced by students.	Retrospective	Process Evaluation
8	Davis (1989)	social science	4	Theoretical construct matrices	Investigate construct validity in measuring a pattern matching approach	Simulation	Validity Issues
9	Dumont (1989)	social science	5	Persons previously institutionalized 2 or more times	Examine whether the statistical analysis compares to the representations and analysis done subjectively by the participants. Investigate whether the statistical analysis does what it proposes to do. Need to investigate the validity of the conceptualizations derived from the statistical purposes.	Retrospective	Validity Issues
10	Galvin (1989)	social services	9	Direct service staff of One to One program	Need to evaluate the One to One program designed for youth in the agency. One to One program matches youth with volunteer mentors in an attempt to provide the youth with structured opportunities. Need to develop an instrument to evaluate the program.	Retrospective	Process Evaluation
11	Jonassen (1987)	education	24	Students in 2 sections of physics taught in a southeastern U.S, suburban high school.	Evaluate whether structure of physics concepts indicated by distances between concepts in pattern notes was similar to semantic distances between concepts generated by word association tasks. Evaluation of teaching methodologies.	Retrospective	Process Evaluation
12	Keith (1989)	education	18	Teacher on computer usage committee in New York	Evaluate the integration of computers into school curriculum using concept mapping procedures and thus make further recommendations about computer use in the district.	Retrospective	Program Theory
13	King, Louis, Allen & Weiss (1995)	business/organization	3, 6, and 10	Teachers from one school (3 female lead teachers with >10 years experience. 6 additional teachers representing academic depts., and 10 other teachers.	Need to assist those involved in school restructuing efforts to learn what and how key concepts are guiding their efforts towards change and how to assist them in reaching a supported common vision within the schools.	Retrospective	Organizational Learning

Id.	Author/Year	Domain of Inquiry	Sample Size N	Sample	Description of Issues and Context	Design	Theory
14	Knox (1995)	business/organization	30 and 15	30 active community relations project workers in Northern Ireland. 15 professionals involved in community relations at policy level including, senior civil servant, sr. local government officials, reps from volunteer sector, researchers and policy expert	Diverse reactions to public policy foster a need for evaluators to review, understand and inform public funding sector on community relations programmes. Need to have guidance for increasing mutual understanding between the two parties (Catholic and Protestants).	Retrospective	Organizational Learning
15	Linton (1989)	social science	84 , 26 and 8	84 self-defined feminist advocates for brainstorm. 26-at first sort, 8 at second	Need to define and focus the meaning of Feminism and explore whether concept mapping method used is in keeping with feminist principles of research.	Retrospective	Process Evaluation
16	Mannes (1989)	social services	12 and 20	Direct service, managerial and case practice workers from government, agencies, state and non profit organizations in South and Midwest States, respectively	Study and compare the perceptions of human service staff employed in direct service agencies in 2 distinct sites in order to plan to implement a social technology family-based intensive in-home services program (FABIIHS) designed to preserve and strengthen families by altering dysfunctional family behaviors and attitudes.	Retrospective	Process Evaluation
17.	Markham, Mintzes & Jones (1994)	education	50	50 students attending state university in south-east; 25 advanced college biology majors; 25 beginning nonmajor students	Explore differences in concept maps constructed by freshmen students and those in advanced biology in order to investigate concurrent validity of concept mapping in relation to knowledge structures and predictability.	Longitudinal	Validity Issues
18.	Marquart (1989)	health	9 and 346	9 health administrators from executive conference. 346 hospital workers	Investigate construct validity of an instrument developed to evaluate a child care program provided by a hospital.	Retrospective	Outcome Monitoring
19.	Martin, Slemon, Hiebert, Hallberg & Cummings(1989)	business/organization	23	23 counsellors: 11 experienced counsellors with >4years experience; 12 novices in 2nd year of masters program in counselling.	Investigate whether differences exist in conceptualizations between novices and experienced counsellors when considering (1) counselling processes and (2) specific problems of individual clients.	Longitudinal	Outcome Monitoring
20.	Miles & Khattri (1995)	education	6	1 principal, 1 chair of core planning committee and 2 other planning members, 1 official facilitator in elementary and high school, 1 other teacher in New York City.	Investigate knowledge and changes in knowledge through restructuring processes. Evaluate impacts of this knowledge on schools and investigate any influences on the impacts.	Longitudinal	Organizational Learning

Id.	Author/Year	Domain of Inquiry	Sample Size N	Sample	Description of Issues and Context	Design	Theory
21.	Morine-Dershimer (1989)	education	4	Matched pairs of senior and masters level students enroled in a 7-week teaching strategies course.	Need for examination of novice teacher changes in thinking about content and pedagogy associated with experiences in teaching in order to explore the roles of reflection in teacher preparation programs.	Longitudinal	Program Theory
22.	Novak, Gowin & Johansen (1983)	education	not indicated	All 7TH grade science classes in School A (mid school) and some 7th and 8th grade classes at School B (junior high).	Analyse curriculum materials to foster curriculum development and increase understanding of principles and concepts in an area of study for both students and teachers.	Longitudinal	Program Theory
23.	Reader & Hammond (1994)	education	16	Male and female students from University of York.	Evaluate the effects of concept mapping tools in hypertext learning and to examine issues in using concept mapping in learning activities.	Longitudinal	Process Evaluation
24.	Rink, French, Lee, Solomon & Lynn (1994)	education	57	20 undergrad students enroled in teacher ed. programs at Southe rn U.S. university (10 completed effective teaching course, 10 completed methods and were student teaching) and 32 from southeastern U.S. 2 teacher educators from USC; 3 from LSU.	Compare and investigate knowledge structures for effective teaching of undergraduate preservice teachers at 2 universities with different education approaches. Evaluate teacher educators' knowledge structures across the universities and with those of their students.	Retrospective	Program Theory
25.	Schmid & Telaro (1990)	education	43	43 male and female students in levels 4 and 5 of Biology 412 in central Canadian high school. Students selected according to their reading abilities.	Evaluate the use of concept mapping as a tool and cost effective strategy and to examine effects that general cognitive ability has on specific processes induced by the technique.	Longitudinal	Process Evaluation
26.	Shern, Trochim & LaComb (1995)	health	11, 9, 5	11 CHOICES staff, 9 Boston University staff, 5 Boston University Centre staff	Evaluate psychiatric rehab program. Problems in quality evaluation arise from neglect of program theory and implementation analysis. These lead to problems of interpreting findings and disseminating these evaluation findings. Concept mapping will be used to evaluate CHOICES. CHOICES program developed by William Anthony and colleagues was based on program theory to assist homeless individuals with mental illness.	Retrospective	Program Theory

Id.	Author/Year	Domain of Inquiry	Sample Size N	Sample	Description of Issues and Context	Design	Theory
27.	Trochim & Linton (1986)	business/organization	45	Planning committee members for each of 11 departments of DCL (Division of Campus Life) at U. S. university including 1 department director, upper and mid-level department administrators.	Need to develop a conceptual framework that could be used as a central organizing device for planning and subsequent evaluations of DCL unit.	Retrospective	Organizational Learning
28.	Trochim & Linton (1986)	health	45 to 77	Staff members of University Health Services at U.S. university including maintenance, physicians, clerical, nursing and administration staff.	Need to organize and plan services and goals of UHS department. Need to prioritize these goals for planning purposes.	Retrospective	Organizational Learning
29.	Trochim (1989)	social services	4	Core staff of multicultural awareness camp for local high school children	Develop an increased understanding and potential outcomes and benefits of the multicultural awareness program through development of concept mapping.	Retrospective	Outcome Monitoring
30.	Trochim (1989)	health	10 to 15	Representatives from United Way, several health and mental health organizations in York County, Maine.	Agencies responsible for elderly care need to develop a conceptual framework for planning appropriate services in York County.	Retrospective	Organizational Learning
31.	Valentine (1989)	health	40, 11, and 12	40 nurses, 11 female patient representatives, 12 nurse researchers and theorists	Evaluate "caring" with respect to nurses and patients. Need to form a conceptualization about caring and development of a questionnaire to measure caring based on theory. There is no agreed upon definition of caring and theory and research about caring does not meet the needs of managers for relevant decision making.	Retrospective	Program Theory
32.	Wallace & Mintzes (1990)	education	91	90 female and 1 male elementary education majors in science education course at eastern university.	To explore the concurrent validity of concept mapping as an evaluation approach for documenting and exploring changes in cognitive structures.	Longitudinal	Program Theory
33.	Weiner, Wiley, Huelsman & Hilgemann (1994)	social services	14	11board members, 1 assistant director, 2 high ranking staff of County Crisis Services unit.	Needs assessment of crisis service agency. Undergo a planning study of crisis services to describe agency status as perceived by stakeholders and to establish a vision for goals, objectives, to guide future planning of services.	Retrospective	Process Evaluation

Purposes of Concept Mapping in Evaluation

Concept mapping has been used for a variety of the purposes in the context of evaluation. Some examples include program evaluations in education and social services; needs assessments and strategic planning; development of evaluation tools and methods; and development of concept mapping methodology itself. Table 2 displays the primary purpose for using concept mapping in each study.

The majority of studies employed concept mapping processes to develop needs assessments and/or planning strategies. Several investigations used concept mapping to undertake program evaluations while significantly fewer studies explored developments in evaluation tools and concept mapping methodology.

Such studies developed needs assessments to identify and clarify specific program services and/or intervention requirements. Others developed conceptual frameworks to guide evaluations, programming and restructuring activities. Caracelli (1989), for example, developed an assessment of women's experiences to explore transition concerns associated with motivation and expectations upon re-entering the educational system. Concept mapping applications identified needs of adult students and clarified specific program interventions that would support the transition process. King, Louis, Allen and Weiss (1995), on the other hand, used concept mapping to guide restructuring efforts. Teacher groups developed concept maps to explore issues about change within schools. Consequently, these maps supported the development of processes for integrating and implementing on restructuring efforts. Miles and Khattri (1995) investigated changes in knowledge occurring during restructuring attempts. In

Table 2 - Purposes of Concept Mapping in Evaluation Applications

Purpose	Identification Number of Corresponding Study (see Table 1)	Examples of Purposes
Program Evaluation	***1,2,14,18,21,22,24,26, 32***	***Study 1*** - Concept mapping used to evaluate the effectiveness of preservice teaching program. ***Study 14*** - Concept mapping is used to evaluate a public policy in Northern Ireland ***Study 22*** - Evaluation of curriculum materials to foster the development and increased understanding of principles and teaching concepts through concept mapping. ***Study 26*** - Evaluate psychiatric rehabilitation program using concept mapping process.
Develop Needs Assessment and Strategic Planning	***3,4,7,12,13,15,16,19, 20,27,28,29,30,33***	***Study 7*** - Concept mapping used as a methodological approach to assist in clarifying scope and interrelations among elements of depression. Used to assess components of depression as viewed by students. ***Study 12*** - Concept mapping conducted with teachers in order to develop a plan to integrate computer technology into a conventional school setting. ***Study 13*** - Used to assess needs of those involved in school restructuring towards concepts of change. ***Study 33*** - Needs assessment of crisis service agency undertaken to describe perceived agency status by all stakeholders. Assessment used to determine the present level of service and to guide needed future services administered through the agency.
Develop Evaluation Tool/Methods	***6,10,11,25,31***	***Study 10*** - Concept mapping used with staff of a Big Sisters/Big Brothers One to One youth program led to development of questionnaire to be used in the evaluation of the program. ***Study 25*** - Examination of concept mapping use as an evaluation tool in biology. ***Study 31*** - Concept mapping used to conceptualize "caring" and the development of a questionnaire to evaluate caring based on the theory.
Develop Concept Mapping Methodology	***5,8,9,17,23***	***Study 8*** - Conceptualized theoretical patterns of construct relationships matched with obtained patterns of interrelated constructs. Investigation of construct validity of concept mapping processes. ***Study 9*** - Investigation of the validity of conceptualizations derived from statistical analysis. ***Study 17*** - Examine concurrent validity of concept mapping by exploring differences between freshmen and advanced students' concept maps in relation to biology.

this study, teachers developed maps to identify key aspects of restructuring processes. These maps supported the clarification and direction of restructuring efforts within the school.

Some program evaluation studies used concept mapping processes to collect information about operations and effects of a particular program, policy and/or intervention. Marquart (1989), for example, used concept mapping to evaluate an employee child care program provided by a hospital. Health administrators' views about the child care program were solicited and responses were compared with those of employee users. In this way, observations about the effectiveness of the program were formulated. Wallace and Mintzes (1990) evaluated observed changes in cognitive structures for preservice teachers in a science methods course over a period of three weeks. Subsequently, the program was modified to meet the needs identified by the evaluation. Others, such as, Knox (1995), evaluated public policies by implementing concept mapping processes with community relation workers in Northern Ireland. Resulting information led to the modification and addition of community relation policies designed to improve relations between Catholics and Protestants.

Studies categorized as developing evaluation tools and/or methods involved research leading to the production and refinement of questionnaires, surveys and other tools to be subsequently used in evaluations of specific programs or activities. In one example, Galvin (1989), developed a participant questionnaire to help evaluate a youth-based, community program. Staff along with the evaluator developed a map to conceptualize all aspects of the youth program. Subsequently, a questionnaire was

created to directly measure dimensions identified in the program map. Other studies developed frameworks from which evaluation tools could be created for use in future evaluations. Cousins and MacDonald (in press) developed a conceptual framework to guide the construction and validation of instruments to evaluate manager training. Through a participatory adaptation of concept mapping, outcomes of successful product development projects were conceptualized. This conceptualization was used to develop a framework from which tools for evaluation of similar manager training projects could be developed and validated.

Of the few studies exploring concept mapping methodologies, most are concerned with construct validity issues. Dumont (1989) investigated the validity of conceptualizations on deinstitutionalisation identified by participants and those identified through statistical analysis. Participants created "hand placed" concept maps identifying factors contributing to living in the community and reinstitutionalization into a psychiatric facility. Specifically, concept mapping participants were asked to place clusters of the information onto a piece of cardboard to create a relational map on deinstitutionalisation issues. Using similar information, computed maps were generated using multidimensional scaling procedures. In turn, the hand placed maps and the computed maps were compared and analysed for similarities and differences. The reported results reflect a high degree of agreement between the two maps and thus support the use of concept mapping processes. In a separate study, Markham, Mintzes and Jones (1994) explored validity issues while investigating knowledge structures with biology freshmen students. Concept maps of mammalian biology topics

were constructed by biology and non-biology students. Biology students appeared to develop more structurally complex organizational patterns of their knowledge of mammals than non-biology students. Notable differences in the complexity of maps supported the assessment of conceptual change and thus supported concurrent validity of concept mapping as a research and evaluation tool in science education. Markham et al., (1984) suggest that concept mapping offers an opportunity to significantly enhance meaningful learning in students while providing an objective, reliable, reflection of student's conceptual organization of a particular domain.

Summary

The predominance of studies used concept mapping to develop needs assessment and/or planning strategies. These studies are consistent with the evolution of concept mapping use in social science domains. Concept mapping studies in planning and needs assessments tended to be associated with earlier studies, while research on concept mapping itself and in evaluation tool development incorporated more recent investigations. Although studies in tool development and methodology are more limited in number, their significance for a new area of study is promising.

Contribution of Concept Mapping to Evaluation Theory

Elements of various theoretical contributions to evaluation are evidenced throughout the studies. These elements are classified in Table 1. Majority of studies support the development of evaluation theory through exploration and expansion of program theoretic approaches to evaluation. In these studies, concept mapping was employed in the assessment, implementation and development of programs. As

indicated previously, Caracelli (1989) explored transition issues experienced by women reentering the educational system. Using concept mapping, change issues were identified and curriculum developed to support the students through the process. Rink, French, Lee, Solomon and Lynn (1994) compared effective teaching structures of undergraduate students in education programs. Identification of program weaknesses and strengths led to the revision of current program curricula. To a lesser degree, studies focused on evaluations with an outcome monitoring approach to evaluation (Affholter, 1994). For instance, Trochim (1989) used concept mapping to identify and clarify program goals and objectives of a multicultural awareness program. The maps generated provided a framework from which components of the program were then monitored. In both program theoretic and outcome monitoring approaches, the concept maps generated were used to help operationalize the program theory including, especially, anticipated effects.

On the other hand, process evaluations explored what the program is and whether the program was delivered as intended (Scheirer, 1994). Generally, several studies used a process evaluation approach to explore issues associated with the delivery of programs. Cohen-Gold (1984) evaluated elements of comprehension, listening and helping to identify goals of a reading skills program. In turn, these factors were examined throughout the program to determine whether the reading course was delivered as intended. In this inquiry, concept mapping was used to clarify program constructs, plan and deliver the program to the targeted audience. In a similar application, Mannes (1989) explored perceptions of staff in a social service agency to

identify program constructs and determine aspects that would be crucial for successful program delivery. Concept mapping reportedly clarified program goals and identified a process for effective program implementation.

Several other studies used concept mapping to foster organizational learning. An organization's capacity to obtain, develop and process information in ways that will improve functioning of current systems was the focus of these inquiries. King et al. (In press) used concept mapping to focus on teacher similarities and differences during school restructuring. Exploration of these divergences helped establish a collective vision leading to restructuring interventions within the high school. On the other hand, Trochim and Linton (1986) used concept mapping to develop conceptual frameworks for several university departments. By involving various stakeholder groups in the generation of the framework, the framework became a central organizing device for planning and implementing various operations within the each of the departments. Concept mapping can be employed to increase group capacity for thinking and jointly exploring knowledge thus leading to the development of collective visioning and organizational learning.

Summary

Arguably, evaluation theory strives to construct new knowledge through process. In essence, all studies can be linked to creation of knowledge through the act of evaluating in and of itself (Shulha & Cousins, 1996). As discussed, concept mapping studies are linked in application to several recent developments in evaluation theory. In particular, concept mapping as an evaluation tool appears to be readily adaptable to

different evaluation designs –black box, grey box, glass box– including outcome monitoring, process evaluation and program theoretic approaches. In addition, concept mapping has been applied in ways that are consistent with evolving theoretical perspectives on evaluation consequences. That is, collaborative and participatory dimensions render concept mapping consistent with conceptions of process use and organizational learning. Concept mapping methods are suitable to a wide range of approaches in evaluation. In this way concept mapping has potential to become an integral method in ongoing development of evaluation theory.

Process Variation in Concept Mapping Applications

Despite variations in application, concept mapping models generally followed three fundamental steps or processes of implementation across the studies. These may be referred to as preparation, construction and interpretation. Preparation focuses on all concept mapping processes that precede actual map formation. Brainstorming, sorting, ordering, prioritizing and rating activities are included in this phase. Construction involves all events occurring in the actual development of conceptual maps. Interpretation on the other hand involves the analysis and exploration of the maps. Variability in concept mapping applications arises in each of these areas. Each study was analysed and displayed across significant dimensions identified in each phase (see Tables 3 and 4).

Table 3 Concept Mapping Process in Preparation

How Generated	*Example*	Who Generated	*Example*	What is Generated	*Example*	Medium for Development of Items	*Example*
Individual ***1,2,4,5,6,7,8, 9,11,13,15,17, 19,20,22,23, 24,33***	***Study 7*** - Participants individually brainstormed on when they last felt "depressed".	Researcher ***3,5,8,11,25,32***	***Study 11*** - Researcher identified several core concepts on Newtonian mechanics for use.	Words ***4,24***	***Study 24*** - Starter word lists were generated by teachers.	Direct ***1,2,6,7,9,10, 11,12,13,14, 16,17,18,19, 20,21,22,23, 24,25,26,27, 28,29,30,31, 33***	***Study 13*** - One on one interviews conducted with each of three participants.
Group ***3,10,12,14,16, 18,21,25,26, 27,28,29,30, 31***	***Study 10*** - One to One program staff brainstormed on the nature and activities of the program in an open discussion. ***Study 12*** - Group of teachers generated ideas about implementation of computer use in the school district	Stakeholders ***1,2,4,7,9,10,1 2,13,14,15,16, 17,19,20,21, 26,27,28,29, 30,33***	***Study 13*** - Feminist advocates generated all ideas for inclusion in the process.	Statements ***1,2,3,5,6,7,8, 9,10,11,12,13, 14,15,16,17, 18,19,20,21, 22,23,25,26, 27,28,29,30, 31,32,33***	***Study 6*** - Short phrases or sentences that described specific attributes associated with successful product development projects were generated.	Indirect ***3,4,5,8,15,32***	***Study 15*** - Participants brainstormed "feminism" through mailed surveys.
Uncodeable ***32***		Mixed ***6,18,22,23,24, 31***	***Study 18*** - Health facilities staff generated ideas about child care assistance program however, researchers selected concepts to be used based on variables being evaluated in the program.				

Table 4 Concept Mapping Process in Construction and Interpretation

Construction				Interpretation			
Who Constructs Map?	**Example**	**How is Map Constructed?**	**Example**	**Who Interprets?**	**Example**	**How is Map Interpreted?**	**Example**
Evaluator ***3,5,6,7,8,10, 11,12,14,15, 16,18,26,27, 28,29,30,31, 33***	**Study 3** - Evaluator chooses 2D map through MDS for ease of interpretation and comprehension.	Individual ***1,2,4,5,8,13, 17,19,20,22, 23,24,25,32***	**Study 13** - Teachers created their owns maps by arranging post-it notes in some order.	Evaluator ***1,3,5,6,7,8,10, 11,14,15,17, 18,21,22,23, 32,33***	**Study 32** - Using split plot factorial designs and hierarchical examination the maps were interpreted.	Individual ***4,5,8***	**Study 5** - Each hierarchical model map was interpreted.
Stakeholder ***1,2,4,17,19,20 21,22,23,24, 25,32***	**Study 1** - Early childhood education majors constructed their own concept maps in class.	Group ***3,6,7,10,11, 12,15,18,21, 26,27,28,29, 30,31***	**Study 26** - Using MDS analysis a 2D concept map was derived.	Stakeholders ***4,13,28***	**Study 28** - University Health Services staff analysed clusters and developed recommendations based on their findings.	Group ***3,6,7,10,11, 12,14,15,18, 28,29,30,33***	**Study 18** - Through MDS analysis of correlations and assessments of pattern matches the findings were analysed.
Mixed ***9,13***	**Study 9** - Participants and evaluators completed separate concept maps. Participants used hand placed maps while evaluators completed computed maps.	Mixed ***9,14,16,33***	**Study 16** - Individual maps for different groups was devised with final integration of individual maps to develop one final map.	Mixed ***2,9,12,16,19, 20,24,25,26, 27,29,30,31***	**Study 16** - Evaluator provided initial interpretation using cluster solution with stakeholders making changes and recommendations	Mixed ***1,2,9,13,16,17 19,20,21,22, 23,24,25,26, 27,31,32***	**Study 17** - Individual maps were examined respectively with overall group implications elicited based on differences and similarities of the individual maps.

Preparation

In preparation, significant differences across the studies is evident in how items are generated and who is actually generating the items (see Table 3). Fifty-five percent of studies applied procedures where items were generated by individuals while in 42% items were generated by groups of participants. For example, in the study by Daughtry and Kunkel (1993) participants generated individual responses to depression. On the other hand, in the study by Keith (1989), 18 teachers generated items in a 20 minute group session.

Sixty-four percent of the studies relied on stakeholders to generate the items, while in 18% of studies either the researcher or a mixed group of stakeholders and researchers generated the items. Knox (1995) incorporated community relation workers in the development of items related to community policies. In contrast, Jonassen (1987) identified several core elements of Newtonian mechanics in literature. These concepts were used for the remainder of the concept mapping process. Cousins and MacDonald (in press) involved managers and researchers in generating items for concept mapping processes. Managers generated information by which a participatory research team, consisting of individuals responsible for the development and implementation of management training and researchers, independently extracted items describing project development programs.

Generally, items were statements, sentences or short phrases about the phenomenon under investigation. Direct methods such as interviews and focus groups

were favoured by the studies (82%) with the remainder using mailed surveys and other indirect techniques to generate items.

Construction

Despite the observation in the present sample of a relatively high involvement of stakeholders during the preparation phase, evaluator presence begins to dominate in the construction phase (see Table 4). Fifty-eight percent of the studies used concept mapping methods where the evaluators was featured as the primary participant in constructing maps. In contrast, only 36% of the inquiries reported stakeholder construction of maps. For example, Galvin (1989) used multidimensional scaling and cluster analysis to develop the concept map on a youth program, while teachers constructed maps in the study by Beyerbach (1988). In terms of how the maps were constructed the distribution between individual and group map formations was about equal. A limited number of studies constructed a combination of individual and group maps. The study by King et al. (1995) used concept mapping applications to develop individual teacher maps that were later integrated into a group map. Linton (1989), in contrast, employed multidimensional scaling to construct a group map on principles and underlying assumptions associated with feminism. Self-defined advocates of feminism were randomly selected to explore the present knowledge surrounding feminism. Knox (1995) used concept mapping to develop both individual and group maps about community relation policies in Northern Ireland.

Interpretation

The present sample of studies reveals that the interpretation phase of the concept mapping process further limits the level of exclusive stakeholder involvement (see Table 4). Fifty-two percent of the studies showed that the interpretation of the maps was exclusively developed by evaluators. However, 39% of the studies relied on procedures that combined the involvement of stakeholders and evaluators in the interpretation of the maps. The degree to which stakeholders are involved in the combined category is usually limited to stakeholders making recommendations and minor changes in cluster solutions. This apparent shift towards an integrated interpretation of maps is consistent with a pattern of further minimization of exclusive stakeholder involvement. Only 9% of the studies involved interpretation by stakeholders exclusively. Individual and group interpretation was conducted in 52% of the research. King et al. (1995) analysed individual teacher maps and respectively identified group implications on restructuring efforts. Morine-Dershimer (1989) interpreted individual teacher maps while analysing knowledge structures for the group as a whole. Exclusive group interpretations were reported in 39% of the studies with only 9% interpreting maps individually.

Summary

In summary, concept mapping applications in evaluation practice vary significantly across the phases. Generally, stakeholder domination in preparation decreases significantly as the process continues to construction and interpretation phases. The majority of studies favour evaluator and integrated approaches to

construction and interpretation. Despite the techniques used, concept mapping applications become more evaluator driven in the later stages of the process. Implications for stakeholder based and participatory evaluations are discussed later.

Variation Across Domains of Inquiry

Concept mapping applications are employed in a wide range of settings and disciplines. Tables 5 and 6 situate the studies by domains of inquiry across the three phases of concept mapping implementation. Specifically, studies were conducted in business, education, health, social science and social service domains. Studies categorized in the business domain represented private sector studies in broad based organizations. Education studies included evaluations conducted in classroom and university programs. Beyerbach & Smith (1990) studied pre-service teacher needs in university, while Nowak, Gowin & Johansen (1983) explored curriculum materials for grade seven students in middle school. Health studies focused primarily on evaluations of medical programs and services, for example, Trochim (1989) explored program planning for elderly clients in several health and mental facilities. Studies of applied academic research were categorized in social science domain. Although many of these studies were conducted in university settings, overall outcomes were not program specific. Social service studies examined programs and services of various social service agencies.

Concept mapping applications varied across domains of inquiry in several ways. Studies in education and social sciences favoured individual generation of items, while

group generation of items dominated health studies. Individual and group generation of items were distributed equally in business and social service investigations. Stakeholder involvement in preparation was predominant in all domains of inquiry excluding social sciences. In social sciences, the trend towards evaluator domination is demonstrated (see Table 5). For instance, individual preferences and continued stakeholder involvement in education studies prevailed, while health studies focused on group preferences with stakeholder involvement. Others such as social services and business supported stakeholder generation of items by individuals and groups. On the other hand, social sciences supported individual evaluators and stakeholders in generating items.

Noteworthy is a prevalent shift towards evaluator domination during the map construction phase evidenced across all domains of inquiry, with the exception of education (see Table 6). Educational studies endorsed stakeholder construction of maps while others adopted procedures in which the evaluator constructed maps. As in preparation, educational studies continued to favour individual map constructions, while health and social services investigations favoured group map constructions. In contrast, social science and business studies supported both individual and group map formations.

Table 5 - Concept Mapping Process by Domain of Inquiry (Preparation Phase)

Domain of Inquiry	How Generated	Who Generated?	What is Generated?	Medium for Items Development
Business/Organization	Individual *6,13* Group *14,27* Uncodeable *32*	Researcher *32* Stakeholders*13,14,27* Mixed *6* Uncodeable	Words Statements *6,13,14,27,32*	Direct *6,13,14,27* Indirect *32*
Education	Individual *1,2,4,11,17,20,22,23,24* Group *12,21,25* Uncodeable	Evaluator *11,25* Stakeholders *1,2,4,12,17,20,21* Mixed *22,23,24* Uncodeable	Words *4,24* Statements *1,2,11,12,17,20,21,22,23, 25*	Direct *1,2,11,12,17,20,21,22,23 24,25* Indirect *4*
Health	Individual Group*18,26,28,30,31* Uncodeable	Evaluator Stakeholders *26,28,30* Mixed *18,31* Uncodeable	Words Statements *18,26,28,30,31*	Direct *18,26,28,30,31* Indirect
Social Science	Individual *5,7,8,9,15* Group *3* Uncodeable	Evaluator *3,5,8* Stakeholders *7,9,15* Mixed Uncodeable	Words Statements *3,5,7,8,9,15*	Direct *7,9* Indirect *3,5,7,14*
Social Services	Individual *19,33* Group *10,16,29* Uncodeable	Evaluator Stakeholders *10,16,19,29,33* Mixed Uncodeable	Words Statements *10,16,19,29,33*	Direct *10,16,19,29,33* Indirect

Table 6 - Concept Mapping Process by Domain of Inquiry During Construction and Interpretation of Maps

Domain of Inquiry	Construction		Interpretation	
	Who Constructs Map?	How is Map Constructed?	Who Interprets?	How is Map Interpreted?
Business/Organization	Evaluator ***6,14,27*** Stakeholder Mixed ***13*** Uncodeable	Individual ***13*** Group ***6,27*** Integrated ***14***	Evaluator ***6,14*** Stakeholders ***13*** Mixed ***27*** Uncodeable	Individual Group ***6,14*** Mixed ***13,27***
Education	Evaluator ***11,12*** Stakeholder ***1,2,4,17,20,21,22,23, 24,25,32*** Mixed Uncodeable	Individual ***1,2,4,17,20,22,23,24, 25,32*** Group ***11,12,21*** Integrated	Evaluator ***1,11,17,21,22,23,32*** Stakeholders ***4*** Mixed ***2,12,20,24,25*** Uncodeable	Individual ***4*** Group***11,12*** Mixed ***1,2,17,20,21,22,23,24, 25,32***
Health	Evaluator ***18,26,28,30,31*** Stakeholder Mixed Uncodeable	Individual Group ***18,26,28,30,31*** Integrated	Evaluator ***18*** Stakeholders ***28*** Mixed ***26,30,31*** Uncodeable	Individual Group ***18,28,30*** Mixed ***26,31***
Social Science	Evaluator ***3,5,7,8,15*** Stakeholder Mixed ***9*** Uncodeable	Individual ***5,8*** Group ***3,7,15*** Integrated ***9***	Evaluator ***3,5,7,8,15*** Stakeholders Mixed ***9*** Uncodeable	Individual ***5,8*** Group ***3,7,15*** Mixed ***9***
Social Services	Evaluator ***10,16,29,33*** Stakeholder ***19*** Mixed Uncodeable	Individual ***19*** Group ***10,29*** Integrated ***16,33***	Evaluator ***10,33*** Stakeholders Mixed ***16,19,29*** Uncodeable	Individual Group ***10,29,33*** Mixed ***16,19***

Although variations noted during construction tended to follow general trends identified in construction, some divergences were demonstrated. Business, health and social services shifted from evaluator-driven applications to more integrated approaches of interpretation. In interpretation, these studies minimized exclusive evaluator involvement, generally, prevalent during construction, and applied mixed interpretation procedures that relied on both stakeholders and evaluators. Social science studies remained consistent across the phases with preferences for evaluator-led group processes. Education studies, however, demonstrated the greatest shifts in concept mapping applications. Education inquiries adopted evaluator-driven interpretations during this phase. Mixed analysis of both individual and group maps was reported by educational studies, while others recorded predominantly group map interpretations.

Summary

In summary, concept mapping applications varied across each phase of the process. Education studies tended to maintain individual stakeholder driven applications during preparation and construction. However, stakeholder involvement was drastically minimized during interpretation. Unlike education, business, health and social services relinquished exclusive stakeholder involvement early during construction. Social science investigations, however, tended to maintain support for evaluator driven applications throughout the phases.

Association with Observed Purposes

In the present sample, it becomes evident that concept mapping processes are linked to observed purposes identified within each study. The distribution of studies across the dimensions in each phase are displayed against observed purposes in Tables 7 and 8. In the preparation phase, studies utilizing concept mapping processes for program evaluations, development of needs assessment and tool creation used a balance of individual and groups in generating items. However, the predominant trend towards the involvement of stakeholders during preparation was reported in program evaluation and need assessment studies. Evaluation tools and concept methodology, on the other hand, included combinations of evaluator and stakeholder involvement (see Table 7).

During map construction, program evaluation and concept mapping methodology studies maintained consistent general trends identified in the preparation phase. However, needs assessment and evaluation tool studies shifted from stakeholder driven to evaluator driven map constructions. Both areas applied group constructions of maps, a shift from individual processes utilized during preparation.

Evaluation tools and concept mapping methodology demonstrated similar trends identified during construction. In contrast, program evaluation studies tended to be devoid of exclusive stakeholder involvement and reported evaluator-driven analyses. Needs assessment inquiries, tended to adopt a combination of stakeholder and evaluator based processes (see Table 8).

Table 7 - Concept Mapping Process in Preparation Phase

Purpose	How Generated	Who Generated	What is Generated	Medium for development of items
Program Evaluation	Individual ***1,2,22,24*** Group ***14,18,21(paired),26*** Uncodeable ***32(preset)***	Researcher ***32*** Stakeholders ***1,2,14,21,26*** Mixed ***18,22,24*** Uncodeable	Words ***24*** Statements ***1,2,14,18,21,22,26,32***	Direct ***1,2,14,18,21,22,24,26*** Indirect ***32***
Develop Needs Assessment, Strategic Planning...	Individual ***4,7,13,15,19,20,33*** Group ***3(preset), 12,16,29,30*** ***27 & 28 used both*** Uncodeable	Researcher ***3*** Stakeholders ***4,7,12,13,15,16,19,20,27 28,29,30,33*** Mixed Uncodeable	Words ***4*** Statements ***3,7,12,13,15,16,19,20,27 28,29,30,33***	Direct ***7,12,13,16,19,20,27,28, 29,30,33*** Indirect ***3,4,15***
Develop Evaluation Tools/Methods	Individual ***6,11*** Group ***10,25(preset),31*** Uncodeable	Researcher ***11,25*** Stakeholders ***10*** Mixed ***6,31*** Uncodeable	Words Statements ***6,10,11,25,31***	Direct ***6,10,11,25,31*** Indirect
Develop concept Mapping Methodology	Individual ***5,8,9,17,23*** Group Uncodeable	Researcher ***5,8*** Stakeholders ***9,17*** Mixed ***23*** Uncodeable	Words Statements ***5,8,9,17,23***	Direct ***9,17,23*** Indirect ***5,8***

Table 8 - Concept Mapping Process During Construction and Interpretation of Maps

Purpose	Construction		Interpretation	
	Who Constructs Map?	**How is Map Constructed?**	**Who Interprets?**	**How Is Map Interpreted?**
Program Evaluation	Evaluator ***14,18,26*** Stakeholders ***1,2,21,22,24,32*** Mixed Uncodeable	Individual ***1,2,22,24,32*** Group ***18 (paired), 21,26*** Integrated ***14 Ind. Matrix group***	Evaluator ***1,14,18,21,22,32*** Stakeholders Mixed ***2,24,26*** Uncodeable	Individual Group ***14,18*** Mixed ***1,2,21,22,24,26,32***
Develop Needs Assessment, Strategic Planning...	Evaluator ***3,7,12,15,16,27,28,29, 30,33*** Stakeholders ***4,19,20*** Mixed ***13*** Uncodeable	Individual ***4,13,19,20*** Group ***3,7,12,15,27,28,29,30*** Integrated ***16,33***	Evaluator ***3,7,15,33*** Stakeholders ***4,13,28*** Mixed ***12,16,19,20,27,29,30*** Uncodeable	Individual ***4*** Group ***3,7,12,15,28,29,30,33*** Mixed ***13,16,19,20,27***
Develop Evaluation Tools/Methods	Evaluator ***6,10,11,31*** Stakeholders ***25*** Mixed Uncodeable	Individual ***25*** Group ***6,10,11,31*** Integrated	Evaluator ***6,10,11*** Stakeholders Mixed ***25,31*** Uncodeable	Individual Group ***6,10,11*** Mixed ***25,31***
Develop Concept Mapping Methodology	Evaluator ***5,8*** Stakeholders ***17,23*** Mixed ***9*** Uncodeable	Individual ***5,8,17,23*** Group Integrated ***9***	Evaluator ***5,8,17,23*** Stakeholders Mixed ***9*** Uncodeable	Individual ***5,8*** Group Mixed ***9,17,23***

Summary

In summary, observed purposes of each study were associated with concept mapping processes in several ways. Generally, program evaluation and needs assessment studies reported stakeholder involvement throughout the phases. On the other hand, studies using concept mapping to develop methodology and evaluation tools, focused on evaluator-driven applications. Although needs assessment studies demonstrated preference for group map interpretations, all studies reported some use of group map analysis. The distribution of studies across observed purposes linked concept mapping applications to either stakeholder-based or evaluator-driven processes, with individual and group preferences distributed inconsistently throughout.

CHAPTER 5: DISCUSSION

In general the applications of concept mapping technology reported in the present sample of studies supports the continued use of these techniques. As the results demonstrate, several concept mapping variations are applied across the studies. The following discussion summarizes the main findings and limitations emerging from this investigation. Contributions to evaluation and implications for future research are then considered.

Summary of Main Findings

As discussed in this study, concept mapping can be a useful tool in formative and/or summative evaluations. Specifically, the majority of studies used concept mapping to develop need assessments, plan future evaluations and perform program evaluations. Several researchers successfully clarified, reported and described various aspects of programming using concept mapping technology. Others used concept mapping to establish a framework from which future evaluations could be developed. To a lesser degree, recent studies, employed concept mapping to develop evaluation tools/methods and to develop enhanced concept mapping methodology itself.

In addition to concept mapping applications in evaluation practice, this study demonstrates the use of concept mapping in supporting evaluation theory. All studies can be linked to the creation of knowledge through the act of evaluating in and of itself. As an evaluation tool, concept mapping is applicable to various -- black box, grey box, glass box-- evaluations as previously described by Scriven (1996). In general, concept mapping applications are consistent with evolving theoretical perspectives on

evaluation consequences. Specifically, concept mapping links to organizational learning theory, outcome monitoring, process evaluation and program evaluation are demonstrated throughout the studies. Similarly, in collaborative and participatory dimensions, conceptions of process use and organizational learning are consistent with concept mapping applications.

Observed concept mapping purposes are complemented by the diversity of applications evidenced across the studies. Despite the apparent variations, all concept mapping models tended to follow preparation, construction and interpretation phases. Variability in concept mapping applications, on the other hand, arises from the assortment of methods implemented during each phase of the process. Arguably, the degree of stakeholder involvement in preparation, construction and interpretation dominates as the emerging dimension by which variations in practice were established. As a practical tool, concept mapping could involve stakeholders in all aspects of the process including preparation, construction and interpretation. Generally, stakeholder involvement in the preparation phase tended to dominate across the research. However, this involvement decreased significantly during construction and interpretation phases, respectively. Similarly, individual versus group applications and the methodology chosen for interpretation provided additional dimensions of diversity across the studies.

Concept mapping applications in this study are employed in business, education, health, social science and social service domains. All domains of inquiry excluding educational research, tended to relinquish stakeholder involvement during

the construction phase. However, integrated approaches between evaluators and stakeholders became more apparent during interpretation phases. Educational research, on the other hand, maintained ongoing stakeholder involvement throughout the process. While business, health and social service studies supported individual and group processes, educational research favoured individual involvement across the phases. The majority of studies favoured a predominantly group-based interpretation of the maps, while educational studies continued to support individual and to a lesser degree group interpretations. Support for evaluator driven applications emerged in social science investigations.

Studies using concept mapping to develop program evaluation and needs assessment reported ongoing stakeholder involvement throughout the process. However, studies focusing on tool and methodology development tended to support more evaluator-driven applications. In contrast, all studies reported some use of group analysis despite preference for individual emphasis noted earlier. In general, observed purposes for using concept mapping processes are associated with the degree of stakeholder involvement and preference for individual or group considerations.

Given the present information, concept mapping appears to be a promising technology in evaluation practice and theory. Several identified purposes coupled with the flexibility of application adds support for this process as an evaluation tool. However, while the studies support concept mapping use, little research specifically aimed at exploring contributions in evaluation exist. More data of this sort would add to

knowledge about when and how to use concept mapping as a general methodological approach in evaluation.

Limitations of the Study

Although ongoing research using concept mapping in evaluation continues to proliferate, investigations exploring concept mapping contributions to evaluation theory and practice remains limited. As well, studies investigating concept mapping as a potential methodology in research are also limited. Inevitably, this study is bound by the quality and context of the research included in the data base. Even though vigorous criteria for inclusion in the present sample strengthens the quality of the present research and limits concerns about validity issues, each individual study is limited by its own contextual nature and limitations. In addition, the contextual nature of each study (e.g., limited studies exploring evaluation contributions) limits the conclusiveness of final statements relevant to potential evaluation contributions. New research could provide more conclusive evidence for concept mapping in evaluation research.

Despite the efforts of this study to present a comprehensive synthesis, ongoing and new investigations are not reflected in the results. In essence, this study can only provide a perspective on concept mapping applications to date. As new studies develop, further aggregation of information and synthesis would be warranted. As research continues to progress, this study might best be viewed as somewhat of a historical foundation for future reference about concept mapping applications in evaluation.

Main Contributions

Concept mapping process can offer evaluators a practical tool that can be applied in a variety of ways. These broad applications offer evaluators, a variety of solutions that can be easily used in a multitude of settings. Variation of applications support the use of concept mapping in formative and summative evaluations. This is consistent with Scriven's dichotomy of judgement-oriented and improvement-oriented evaluations. Although these evaluations are dependent upon the epistemological research paradigm adopted, as a methodology, concept mapping is operative in both qualitative and quantitative venues. As such, concept mapping supports diversity in application as well as methodology and is able to support a broad range of investigations and research paradigms. Underlying assumptions and principles of concept mapping are easily incorporated with researcher and/or evaluator preferences.

As a process, the various concept mapping applications support outcome, program and process evaluations. Specifically, outcome-based and program theoretic approaches can be successfully defined, refined and intricately explored using concept mapping technology. This extends to Scriven's analogy of --black box, grey box, glass box-- evaluations. In these instances, concept maps can identify and clarify constructs of programs during preparation and construction. The cluster map can be used as a guide to identify implementation problems and areas needed for modification (formative) or formulate the basis by which program decisions are fostered (summative). Essentially, concept mapping is a valuable tool that can be used by

evaluators and researchers to construct and develop understandings of relationships between concepts in a given area of study.

As previously discussed, concept mapping is theoretically based in assumptions supporting knowledge as a socially constructed entity. This adds to Bandura's research emphasizing the importance of socially constructed thoughts that enhance learning at both individual and group levels (Bandura, 1986). Specifically, variations in concept mapping applications adopt varying levels of social processing in order to enhance individual and group learning. Consistent with progressive views of evaluation, knowledge creation is supported by a system in which complex phenomena are represented and clearly understood. Concept mapping process can extend beyond the entity being evaluated and support the consideration of broader impacts of the phenomenon under investigation. Through presentation of symbolic systems -- a map-- shared common understandings of an entity, for example an organization, can be developed. In so doing, concept mapping in evaluation lends itself to the development of organizational learning and broadened evaluation utilization. In this manner, concept mapping in evaluation theory strives to create knowledge through processes that foster learning and utilization. This is consistent with Bandura's (1986) notions of the development of a shared, common understanding of an organization and its operations in order to foster organizational learning.

While emphasis for concept mapping use as an evaluation tool is established in the research, apparent support for various evaluation methods is continuing to surface. Specifically, the degree of stakeholder involvement in the concept mapping process

holds promise for participatory based evaluations. In using concept mapping, participatory evaluators can maintain strong stakeholder involvement throughout the process. Although no particular venue or approach exclusively supports full stakeholder involvement, the "Strategic/Emergent" Approach and other approaches tend to demonstrate more participatory dimensions.

In this study, concept mapping has significantly contributed to the establishment and development of both evaluation practice and theory. As a tool, concept mapping supports the development of formative and summative evaluations in outcomes, program theory and process. As a process, concept mapping is consistent with broadened evaluation views of knowledge creation. Through development and clarification of complex phenomena, concept mapping in evaluation establishes a pathway by which interpersonal connections and dialogue can be fostered. Inevitably, this process fosters learning and utilization and in itself fosters knowledge creation.

Implications for Research

As potential-laden as concept mapping may seem, this study acknowledges the need for future research in this area. Most obviously, development of future research on concept mapping methodology itself is necessary to provide a comprehensive view of the underlying factors and assumptions adopted in each concept mapping approach. Other than a few studies exploring construct validity, empirical ventures investigating general validity and reliability issues in concept mapping have not been fully explored. More specifically, several areas seem particularly vulnerable. For instance, validity and reliability of multidimensional scaling used in the "structured approach" has not

been determined. As well, the integration of multidimensional scaling and more emergent concept mapping processes have not been explored with respect to validity and reliability of use. Further investigations exploring the development of evaluation tools using concept mapping are necessary to substantiate definitive claims in this area. Although this study helps to inform and provides a summary of the thinking about concept mapping technology in an evaluation perspective definitive answers are not forthcoming. This study by no means, is able to provide definitive answers regarding researcher preference and perspectives in reasons for undertaking a particular concept mapping application. Clear, strategic investigations of research paradigms with respect to concept mapping use could help to focus some of these perspectives.

In addition to future research in evaluation practice, studies exploring potential contributions to theory are critical. On the basis of the present data, although connections to process evaluation and organizational learning theory are witnessed, direct contributions to theory have not yet been fully explored. Investigations seeking to answer questions regarding the creation of knowledge through concept mapping processes are necessary. More studies that empirically explore organizational perspectives and process evaluations are required to substantiate any claims made to date on these issues. Finally, more detailed exploration of concept mapping in general (i.e., outside of evaluation) may provide insightful knowledge into potential uses in evaluation practice and theory.

How is concept mapping used in research today? Why is a particular application chosen over another? What assumptions are held by each of the applications? These are but a few of the many valued directions future research might follow.

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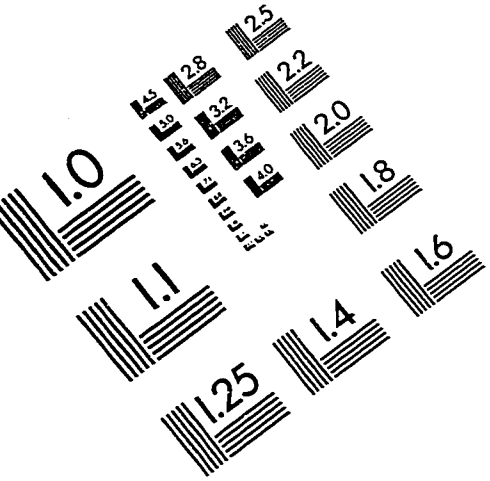
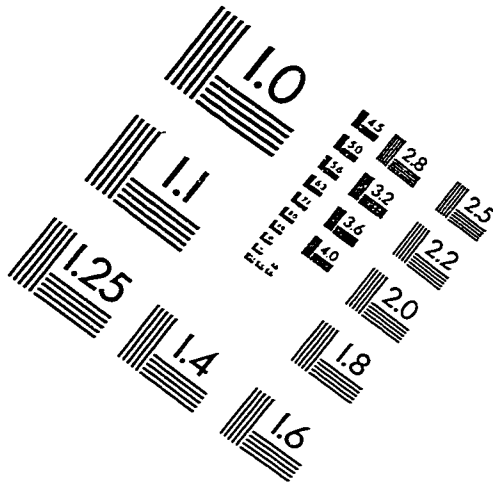
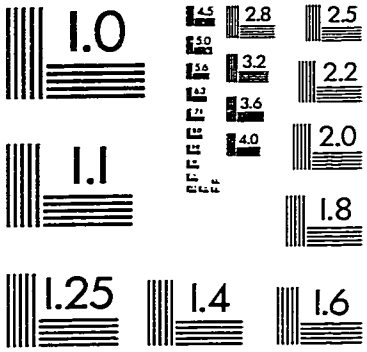
Appendix A: Initial Summary Sheet

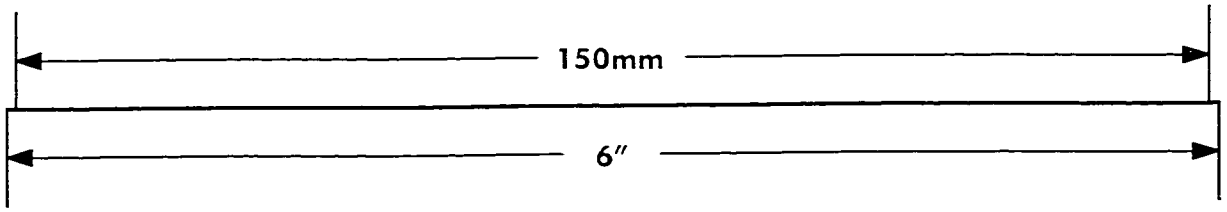
Author: *Full name of all researchers involved*
Title of Study: *Full title of research study*
Year of Study: *Year study was published*
Source: *Name of journal, book, report, conference and organizational affiliation.*
Data Quality:
a1 **Refereed journal:** *yes* ___ *no* ___
a2 **Dissertation:** *yes* ___ *no* ___
If no to a then
b1 **Author credibility:**
Social science citation index *yes* ___ *no*___
(Median citation 1/year over past five years)
Data Collection:
Field of sample:
business ___
education ___
health ___
medicine ___
psychology ___
social services ___
other: (specify) _____
_____
_____
Sample size: _____
Design:
1. Preordinate ___ *Emergent* ___
2. Retrospective ___ Longitudinal ___ Simulation ___
3. Single Case ___ Multiple Case ___ Survey ___ Quasi Expt ___
Instruments:
interviews ___
participant observations ___
rating scales ___
standardized tests ___
surveys ___
other: (specify) _____
_____
Connection to Evaluation Theory/Practice:
Concept mapping use within the study is described in relation to evaluation.(e.g., as an evaluation tool, research tool to study evaluation)
Description of Use Within Study:
Details of process of concept mapping procedures used within the study.
Concept Mapping Technique
Multidimensional Scaling ___
Subjective Scaling ___
Other Approach ___
Comments :_____
Participant Role
All phases ___
Some phases ___
Limited ___
Study Location:
Brief record of how study was identified.
ERIC ___ DAI ___ REC ___ Psychinfo ___ Wilson ___
Conf ___ Sociofile ___ Bib. Follow ___
Impact:*Brief overall comments on the potential study contributions to evaluation. Preliminary thoughts on the study should be included. Section for future references.*

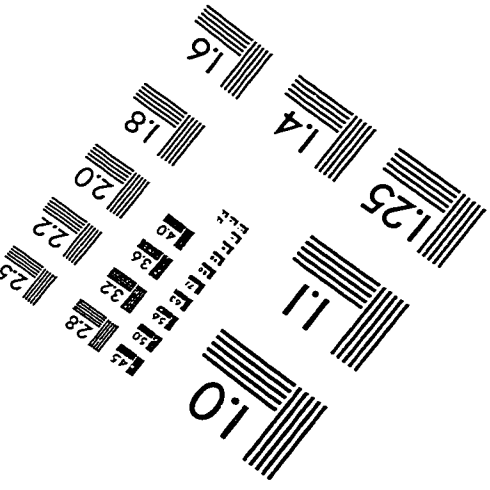
IMAGE EVALUATION
TEST TARGET (QA-3)

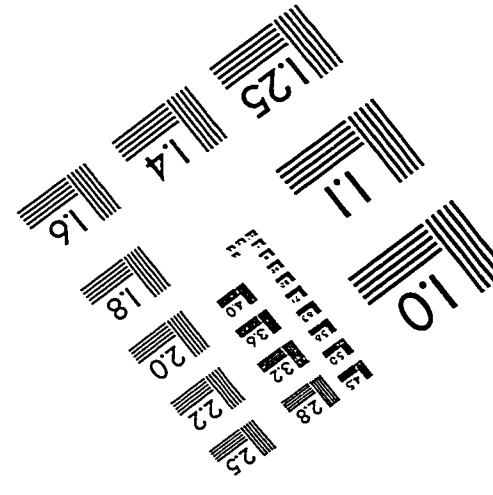












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