**Chapter Seven – Creative and Critical Thinking Using the Idea Database**

**Abstract**

**Creative and critical thinking has been considered to be an individualistic behavior associated with individuals of high intellectual capability. That process, however, was more related to applications of methodology. One approach employed methods from artificial intelligence, wherein, software was developed to mimic some of the intellectual activities exhibited by the specialist. Contextual Analysis is one of these methods. It is based on the management functions originally designed to process numeric data. A shift to alphanumeric data was effective when the essential data was chosen to be authors’ ideas. These were extracted from authors’ sentences and organized as data records. Repeated studies during the past 30 years dealing with numerous subjects confirmed the feasibility of software to recognize, extract, and organize data in the form of ideas. The resulting databases facilitated a shift from clerical tasks to intellectual ones. The result was increased attention to a transparent, quality controlled approach to the higher cognitive functions. As such, application of technical and software algorithms made creative and critical thinking a learned procedure.**

**Introduction**

**The idea database may be considered as an important resource in developing an operational path to creative and critical thinking. The rationale for the idea database and its associated operational behaviors is due to the available time and energy saved by developing a more effective data identification, capture, and organizational approach. That mechanical energy can be transformed into cognitive functions enabling a more intense consideration of the three important elements in critical and creative thinking. Those are *measures* used to describe attributes of characteristics, *criteria* used to evaluate the measures and interrelationships, and *decision-rules* defining behaviors based on the measures and criteria.**

**Using the Research Template**

**The template is helpful in organizing ideas into possible strategies. Each can be compared with the others to determine the ones most interesting and feasible.**

**Using an Algorithmic Approach to Assist in Creative and Critical Thinking**

**Traditionally, creative and critical thinking have been regarded as behaviors restricted to the capabilities of the individual. A common assumption has been that the individual possessed inheritable characteristics that made these intellectual activities possible and effective. If those perceptions were true, the delays in dealing with complex problems could be explained in terms of waiting for the genius interested in the problem and willing to solve it.**

**If however, critical and creative thinking is a learned behavior, then the number of individuals performing such behavior could markedly increase. The focus on ideas and their innate ability to be combined in a variety of ways, suggest that algorithms could be developed to assist the individual in producing the varied arrangements of ideas and in choosing the arrangement offering maximal success.**

**Bloom’s Taxonomy of Learning and Weiner’s modification of it suggest that the cognitive functions making up the learning process can be considered separately. Each function could be divided into three components – development of measures describing attributes of characteristics involved in the function; development of criteria for dealing with the results of those measures; and development of decision-rules for instituting specific reactions or behaviors. These possibilities plus the independence of ideas give justification for attempting to construct operational translations of the cognitive functions.**

**If ideas are the essential data in information utilization, an approach such as the one described should provide significant benefits.**

**Research Process**

**There is a ‘*natural*’ investigative process that is well accepted in research methodology. That process involves the following steps:**

1. **Determine the existence of a problem**
2. **Develop a detailed description of that problem.**
3. **Develop an appropriate intervention to correct or eliminate the problem.**
4. **Conduct a detailed, quality-controlled process to bring the intervention and the problem together.**
5. **Capture the findings of this interaction.**
6. **Analyze the findings against the original description of the problem.**
7. **Develop and disseminate the results of the process with emphasis on the modifications necessary to existing knowledge.**
8. **Ensure that others can benefit by making the development process transparent.**

**Determining Existence of a Problem**

**There are two different approaches to this objective. One is based on the premise that the individual observes a discrepancy in the course of daily activities and translates that into a statement of the problem. The second is based on the premise that the individual studies the literature and discovers an omission or a discrepancy that leads to recognition of the problem.**

**The idea database makes this requirement feasible and timely by displaying the ideas considered by the subject specialists. That process should lead to the discovery that an idea has not received sufficient attention or that there is a disagreement relative to the importance of the idea. These observations should lead to a new arrangement of the ideas in the form of a new research strategy. This process could be reasonably called the *discovery of a problem by discovering an idea*.**

**Description of the Problem**

**Using ideas facilitates development of a description of the problem to be studied. The previous work is readily identified using the specific ideas and the organization of these ideas as a research strategy leads to the development of a description of what’s intended.**

**Develop Interventions**

**In considering the previous work and in developing the relationships between personal, subject, and outcome factors, plausible interventions will be recognized. The interventions selected will be based on previous success, costs of conduct, and specificity in terms of changing the relationship between the subject factors and the outcome factors involved. One of the advantages of the descriptive-intervention study design is the rapid assessment of an intervention in the context of the subject and outcome factors. This design provides an estimate of change and could lead to a more definitive problem description with enhanced specification of the subject, intervention, and outcome factors to be studied. Methods also can be improved and/or replaced.**

**The importance of choosing effective interventions is obvious but not alone in the study process. Choosing the optimal personal, environmental, subject, and outcome factors together with the best available methods in carrying out the study are all desirable and important. As such, the *natural investigative process* is not a one-time operation but one that is continuously probing to determine the appropriate elements to include in a given study. Like the chain’s weakest link, the flawed dimension or factor could jeopardize the success of the whole study.**

**Development of the Protocol**

**The plan of requirements and procedures involved in performing the study is called the protocol. This document should be as detailed and specific as possible. It translates the ideas involved in forming the research strategy into an executable set of tasks. Training of study staff in carrying out the procedures is essential as is the instruction of the respondents with respect to what to expect and why. Whether the study is descriptive (i.e., survey, interview, focus group) or interventional (preliminary or definitive), the participants (respondents and staff) must be aware of the issues and procedures being studied in order to ensure that the information captured is as correct and complete as possible.**

**Study Conduct**

**Once the protocol is completed and the participants properly informed, the study can be initiated. An important requirement is that the data being captured are carefully edited and assessed to determine accuracy and completeness. Flaws must be corrected and could lead to significant changes in the protocol. This continual assessment is an important justification for multiple descriptive-interventional studies before a presumably definitive interventional study is launched.**

**Analysis of Results**

**Analysis of data is a continuous process throughout the duration of the study. The segments of the study require different types of analyses. The recruitment and eligibility of respondents sets the stage by defining the population actually studied. The characteristics of the study subjects define the conditions under which the subject factors exist. The effect of the interventions and the degrees of change are indicators of achievement in altering the problem initially identified. Finally, the outcome factors and their rankings in terms of change are ultimate measures of the effects of the interventions.**

**Preparation of Reports**

**The reports emanating from a study are numerous and are designed to better describe the individual dimensions and the relationships between them. These reports should emphasize the measures, criteria, and decision-rules that make the results and their interpretation realistic and helpful in expanding the body of knowledge.**

**Data Curation**

**The data from the study provide different components of information. The textual documents in the form of problem development, protocol, and reports contribute significantly to future studies. Preparing the data for effective utilization by other investigators requires a methodology such as the contextual analysis approach. With that, the different texts can be presented in a usable fashion.**

**The numerical data storage and subsequent use has been repeatedly addressed over the years. The comparability between studies has been a major drawback. This problem could be more effectively addressed by adopting a uniform idea database at the outset and employing uniform methods where available. Any method can be translated into involved measures, criteria for assessment, and decision-rules for using the measures and criteria. With the major effort associated with text retrieval and triaging eliminated, there would be more time and energy available for focus on measures, criteria, and decisions.**

**Natural Investigative Process and Cooperative Research**

**Earlier, it was suggested that the idea database facilitated cooperative development of descriptive-interventional studies leading to a definitive interventional one. The *natural investigative* process is not a one-time event. Instead, it is a series of small clarifying studies that help to identify the specific factors to be included in each dimension as well as the interventions that show the most promise of changing the relationships between the subject and outcome factors.**

**Accomplishing the intended objective of building a definitive interventional study requires the concerted efforts of numerous investigators. How can this effort be best accomplished? The approach suggested was to form a cooperative research group. The selection of studies would be determined by considering the ideas from the central idea database, a uniform set of methods, and a willingness to work together in solving the identified problems.**

**The central database of ideas would assist in bringing a consensus among the experts with respect to the starting level of knowledge and the need for coordinated investigations. With each investigator contributing a significant piece of the overall, evidenced-based approaches to the management of these complex and expensive events would be feasible and realizable. The intellectual benefit would be seen in a transparent, quality-controlled approach to critical and creative thinking.**

**An important feature of research involving multi-dimensional knowledge is the realization that numerous subject factors and interventions may be required before significant change is observed in an outcome factor. The focus on ideas allows construction of new strategies rapidly and easily. With a comprehensive and accurate set of ideas depicting the topic, investigators have the advantage of starting on a common ground. What is done subsequently is a matter of individual intellectual prowess. In that way, uniformity of approach to critical and creative thinking is a possibility. The uniformity stems from the application of the specific procedures in carrying out each cognitive function. The final results can be diverse depending on the measures, criteria, and decision-rules employed.**

**The Descriptive-Interventional Design**

**This study design often is described as preliminary or pilot. The study is effective in developing more specific questions for study but rarely produces answers. While these preliminary studies provide insights with respect to the characteristics needed for accurate description plus estimates of the degree of change offered by the interventions, funding agencies tend not to fund them.**

**Advantages of the Descriptive-Interventional Design**

**A measure of ‘truth’ in science is the ability to replicate the findings in different situations. This consistency may be of greater interpretability than a single large study. A second advantage may be the identification of different relevant attributes and characteristics together with the measurements-observations depicting them. Having different investigators pick, independently, the measures, criteria, and decision-rules in each study offers a more complete picture of the knowledge structure.**

**A third advantage is the ability to employ a variety of interventions. These findings would be relevant in determining the better ones to employ in the definitive study. The combination of subject factor to be influenced, the intervention chosen to be the influencer, and the outcome factor representing the degree of change provide an important component in the determination of the ultimate study. Having different investigators determine these interventions again offers a form of consensus when the same intervention is studied in different places and a diversity of results when different ones are studied.**