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CHAOS THEORY IN EDUCATIONAL SYSTEMS:
PRINCIPALS' PERCEPTIONS OF SENSITIVE DEPENDENCE ON
INITIAL CONDITIONS

A Dissertation
Presented to
the Faculty of the Department of Educational Leadership
and Policy Analysis
East Tennessee State University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

by
Suzan Bumgarner Baker
December 1995

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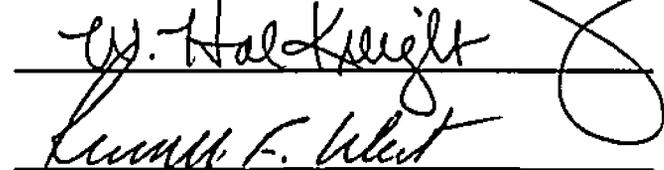
SUZAN BUMGARNER BAKER

met on the

1st day of August, 1995.

The committee read and examined her dissertation, supervised her defense of it in an oral examination, and decided to recommend that her study be submitted to the Graduate Council, in partial fulfillment of the requirements for the degree of Doctor of Education in Educational Leadership and Policy Analysis.


Chair, Graduate Committee


W. Hal Knight

Russell F. West

Signed on behalf of
the Graduate Council


Interim Dean,
School of Graduate Studies

ABSTRACT

CHAOS THEORY IN EDUCATIONAL SYSTEMS: PRINCIPALS' PERCEPTIONS OF SENSITIVE DEPENDENCE ON INITIAL CONDITIONS

by

Suzan Bumgarner Baker

This study investigated the characteristic of chaos theory called sensitive dependence on initial conditions or butterfly effect in schools and school systems. The purpose of the study was to develop insight into school systems by determining if categories or factors of behaviors or decisions have been observed in school systems which are sensitive to initial conditions and are therefore likely to produce exponential effects.

A modified critical incident technique was used to collect data from experienced principals in three moderate sized regions in Tennessee, North Carolina, and Virginia. Participants reported incidents that were sensitive to initial conditions during interviews.

The data were analyzed by summarizing incidents reported in interviews and sorting to determine factors in schools and school systems which were sensitive to initial conditions. Six factors of schools were identified from data reported by principals that generated butterfly effect incidents. Those factors included curriculum, discipline, extracurricular activities, personnel, school community, and transportation/facilities. School system levels of origination of incidents were also identified with most incidents beginning at the school level. Also principals reported more incidents were precipitated by decisions than by behaviors. Categories of ripple effects of incidents also emerged from the data analysis. These included initial, communication, emotional, mediation, news media, coercive, and outcome ripple effects.

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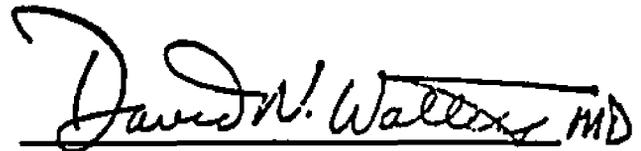
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PROJECT TITLE: Chaos Theory and School Systems.

PRINCIPAL INVESTIGATOR: Suzan B. Baker

The Institutional Review Board has reviewed the above-titled project on December 5, 1994 with respect to the rights and safety of human subjects, including matters of informed consent and protection of subject confidentiality, and finds the project acceptable to the Board.

A handwritten signature in cursive script that reads "David N. Walters M.D." with a horizontal line drawn underneath the signature.

David N. Walters, M.D.
Chairman, IRB

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DEDICATION

This dissertation is dedicated to
my family.

ACKNOWLEDGMENTS

I am very grateful to the members of my dissertation committee for their time, expertise, recommendations, and support. Sincere thanks and appreciation are expressed to my chair, Dr. Donn Gresso, and the members of my dissertation committee, Dr. Hal Knight, Dr. Russell West, and Dr. Cecil Blankenship. Their enthusiasm for a less than conventional topic and willingness to struggle with me in its development are a tribute to the quality of the leadership in the Department of Educational Leadership and Policy Analysis. Thank you.

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CHAPTER 1

Introduction

A mechanistic, clockwork worldview based on the science of Descartes and Newton provided the perspective for the early management thinking of Taylor, Weber, and others. Scientific management theory was fixed, linear, and bureaucratic with chains of command, rules and regulations, and organizational charts. Einstein's relativity theory, Heisenberg's uncertainty principle (quantum physics), autopoietic systems in biology, and chaos theory contribute to a new science and to a new worldview. Organizational theory has historically been founded in science and if it continues to develop from a scientific perspective, it must consider a new worldview.

Within these new sciences, chaos theory has provided the impetus for some recent innovations in organizational theory (Morgan, 1993; Stacey, 1992; Wheatley, 1992). Morgan maintained that this postmodern worldview was based on the chaotic, paradoxical, and transient nature of disorder and order. This perspectival evolution paralleled the development of new discoveries in the sciences. This new perspective contrasts the mechanistic fixed, linear theories of management whose roots were founded in Newtonian science. The purpose of the study is to investigate the extent to which chaos theory has utility in school systems by focusing

on the butterfly effect, also known as sensitive dependence on initial conditions.

Gleick declared that this butterfly effect "lurks everywhere" (1987, p. 67) in complex systems and that sensitivity to initial conditions is a creative force. He continued that tiny differences in input could quickly become overwhelming differences in output. "In weather, for example, this translates into what is only half-jokingly known as the Butterfly Effect--the notion that a butterfly stirring the air today in Peking can transform storm systems next month in New York" (p. 8). Mathematically speaking the butterfly effect means that any input error multiplies itself at an accelerating rate exponentially (Davies, 1990). Percival proposed these metaphors for the butterfly effect, situations in the environment which are balanced on a knife-edge or the straw that can break a camel's back (1989).

The work of educational administrators is complex, elegant (Blumberg, 1989), and unpredictable (Blair, 1993). Sergiovanni and others recognized the intricacy of administering schools and contended that understanding them demands a complex framework (Sergiovanni, Burlingame, Coombs, & Thurston, 1992). Understanding this complex framework may be enhanced by learning about the characteristics of chaos theory including the butterfly effect. Chaos theory is an interdisciplinary concept which

describes dynamic complex systems. One example of a such a dynamic complex system is a school system.

Chaos theory emerged in the 1970s from the work of mathematicians, physicists, biologists, meteorologists, astronomers, and other scientists (Gleick, 1987). Chaos here does not mean without order or form, but refers to a science of dynamic systems, a science of process, not a science of state (Gleick; Wheatley, 1992). Rockler maintained that reflection on chaos theory and schools and school systems may provide educators with another tool for thinking about their work (1990-1991).

The administration of school systems as a profession distinct from teaching began around 1900 (Sergiovanni et al., 1992). During the first 30 years of the 20th century scientific management and organizational efficiency dominated the organizational theories of educational administration. A focus on human relations theories was the prevailing ideology from about 1930 until the mid-1960s. Then, after World War II, political views and decision-making views became popular. These views placed an emphasis on the relationship of organizations with their external environments on policy development and on conflict as a natural and necessary process. Current educational administrative theories include organizational culture, reflective practice, and educational administration as craft.

Wheatley (1992), Morgan (1993), and Stacey (1992) proposed that chaos theory could inform organizational theory. Gleick (1987) and Stewart (1989) referred to chaos as the "new science," the science of turbulence, the science of dynamic systems. "Chaos" in chaos theory does not refer to the commonly accepted definition as a state of complete disorder and confusion. Devaney defined chaos as the mathematical term for an inherently unpredictable system (1990). Greenwood, Bartusiak, Burke, and Edleson (1992) contended that chaos is apparently random behavior with an underlying order. Chaos theory for this study will be defined as a description of a turbulent, unpredictable, positive feedback system with sensitive dependence on initial conditions.

Chaos theory dates back to the work of French mathematician Poincaré at the beginning of the 1900s as he worked on the orbits of three celestial bodies and their mutual gravitational attraction. In the last decade it has been applied to many disciplines by mathematicians, scientists, and engineers. According to Ott (1993) the implications and directions for chaos theory continue to grow and many fields need to understand the science of chaos. The knowledge base and the basic paradigm of education will need to be modified as a result of chaos theory (Rockler, 1990-1991). Peca concluded that chaos theory "perhaps, will allow greater tolerance for

alternative paradigms in educational administration" (1992, p. 25).

Much organizational theory has been based on a mechanistic view of the world with fixed theories and linear methods (Morgan, 1993). Theories of school organizations developed from these business theories. Many times administrators find themselves in dead organizations, drowned by change, hoping for patience and endurance to deal with the unpredictability of practice (Wheatley, 1992). It is not surprising to find that Newtonian linear theory is not the most useful for complicated dynamic organizations, where effects cannot always be linked in practice to a cause. The administration of education is unpredictable and often produces unexpected responses to seemingly ordinary actions (Blair, 1993). Organizations are complex and constantly changing (Hoy & Miskel, 1991, p. 23); school systems are one of these dynamic organizations with a constantly changing environment.

Statement of the Problem

Chaos theory has proven useful in understanding how characteristics of organizations function. School administrators must daily attempt to work successfully within the complexities and intricacies of school systems. These dynamic, complex school systems must respond to an ever changing environment. Decisions and behaviors in

educational systems often produce unexpected responses to seemingly routine choices. Chaos theory has been used by businesses to inform organizational theory and educational systems have historically relied on business for theory development. The problem for this study was that research dealing with chaos theory and school systems was very limited. This study was an effort to explore the potential of chaos theory to inform educational theory of school systems. This study sought to inform educational theory of organizations. It was intended to provide a link between theory and practice and in doing so to add another construct for thinking about school systems.

Purpose of the Study

The purpose of the study was to investigate the characteristic of chaos theory called sensitive dependence on initial conditions (the butterfly effect) in school systems. The purpose was also to develop insight into school systems by determining if categories of behaviors or decisions have been observed in school systems which were very sensitive to initial conditions and were therefore likely to produce exponential effects.

Significance of the Problem

The administration of education is one of the largest of public and private enterprises with more than two million

teachers and 60 million students in thousands of schools (Sergiovanni et al., 1992). Schools are one of the complex organizations which make up modern societies (Etzioni, 1961). The administrative functions of schools are many--decision making, evaluating, budgeting, planning, organizing, staffing, directing, and scheduling. And modern administrators must also successfully deal with the daily fluctuations and crises which arise. Chaos theory applied to the administration of complex educational systems could become another useful tool for thinking about school systems and operating more successfully and efficiently within school systems. Devaney (1990) contended that unpredictable phenomena are found in all areas of life. Educational systems are innately unpredictable (Blair, 1993). If guiding precepts can be developed, then perhaps school leaders can gain wisdom from a new worldview through the experiences of other administrators. Insights from chaos theory may enhance the art and craft of administration. The application of chaos theory to social science systems is relatively recent and educational researchers should investigate this new paradigm for organizational thinking.

Research Questions

The following research questions were developed to guide the study.

1. Can the butterfly effect be identified in school systems?
2. Are there factors or categories of critical incidents which can be discerned in school systems?
3. Is the butterfly effect precipitated at the school, district, state, or national level of school systems?
4. Is the butterfly effect precipitated at the school or classroom level of school systems?
5. Can similar behaviors or patterns of behavior result in the butterfly effect in school systems?
6. Can certain decisions or categories of decisions be identified which precipitate the butterfly effect in school systems?

Assumptions

It was assumed that due to the complex and systemic nature of school systems that characteristics of chaos theory would be found. It was further assumed that professionals by their agreement to be interviewed would provide professional insight and accurately recall incidents. Also it was assumed that professional ethics were observed by researcher and participants.

Limitations

The limited research involving chaos theory in educational literature presented no precedent for dealing

with a very complex theory and its application to school systems. The study was further limited by the researcher's inability to investigate the phenomenon over a large geographical area or with a large population of participants. The nature of the interview technique and the critical incident technique thus were limiting factors. Also the data were not generalizable to other populations.

Definitions of Terms

1. Chaos--For this study chaos described phenomena that are complex and unpredictable but have underlying repeating structures or patterns and exhibit sensitive dependence on initial conditions.
2. Critical incident technique--a method of collecting data from anecdotes or stories that pertain to an activity (Flanagan 1954).
3. Butterfly effect--the butterfly effect referred to the extreme sensitivity to initial conditions in educational organizations, which may have enormous ramifications over time.
4. Long interview--the long interview is an interview which is guided by a questionnaire and focuses on the experiences and perspectives of the participant (McCracken, 1988).

Overview of the Study

The first chapter included the introduction, the statement of the problem, the purpose of the study, the significance of the study, the research questions, the assumptions, the limitations of the study, the definitions, and an overview of the study.

Chapter 2 contained a review of the literature and research.

The research design and method used in the study were detailed in chapter 3.

Chapter 4 presented the data which addressed the research questions.

The summary, observations, and recommendations from the study were found in chapter 5.

CHAPTER 2

Review of the Literature

Introduction

Chapter 2 was designed to provide an overview of the development of chaos theory. The application of chaos theory to complex systems across many disciplines was reviewed. The impact of chaos theory on organizational thinking and its use in business were reported. Finally, the research regarding chaos theory and its application to social systems and to school systems was limited and concluded the review of literature.

During the last few thousand years (Stewart, 1989) humans have discovered the laws of nature. In fact, by the 18th century, immutable mathematical laws were thought to control all of the motion and the matter in the universe. From Newton's *Mathematical Principles of Natural Philosophy* the message was that nature was governed by laws and these laws can be determined. This Laplacian universe was viewed as a gigantic clockwork mechanism--predictable, mechanical, and perfect. "The paradigm of classical determinism was born" (p. 12).

Newtonian laws could not account for the flow of fluid systems, fluctuations in populations of organisms, the paths of lightning, the networking of blood vessels, the tumbling of Hyperion, weather patterns, the reversing of the earth's

magnetic field, and many other natural phenomena (Gleick, 1987; Stewart, 1989). Turbulence is extremely important in many scientific fields and practical engineering problems (Stewart).

However, this dynamical side of nature, turbulence, disorder, and fluctuation, have been impossible to determine mathematically (Stewart, 1989). Equations for these nonlinear systems usually cannot be solved (Gleick, 1987). "Nonlinearity means that the act of playing the game has a way of changing the rules" (p. 24). Gleick also asserted that solving nonlinear equations is analogous to walking through a maze which is rearranged with every step taken.

The science of chaos has become the "science of process rather than state, of becoming rather than being" (Gleick 1987, p. 5). Chaos appears in phenomenon ranging from the behavior of a column of cigarette smoke to the arrangement of cars on an expressway. Chaos is a science of the global nature of systems. The study of chaos spans many disciplines and brings together scientists from different areas. The pulling together of many disciplines or multidisciplinary characteristic of chaos theory is the reverse of specialization. Chaos can be applied to "the universe we see and touch, to objects at human scale" (p. 6). Chaos is a science able to deal with the messy real world. David Pines, a theoretical physicist, reported that understanding chaotic systems may result in a better

understanding of human behavior in organizations and societies (Waldrop, 1992).

The Development of Nonlinear Systems and Chaos Theory

James York, a mathematician, coined the term chaos to describe deterministic disorder. York (cited in Gleick), stated that "the first message is that there is disorder. Physicists and mathematicians want to discover regularities. People say, what use is disorder. But people have to know about disorder if they are going to deal with it" (1987, p. 68). York contended that scientists and others could easily misunderstand complexity if they are not made aware of its nature.

The study of the irregular, bizarre behavior of these nonlinear systems was predicted by Poincaré at the turn of the century. Poincaré was studying the orbits of three celestial bodies and their mutual gravitational attraction. He demonstrated that very complex orbits were possible (Ott, 1993). According to Dresden he developed a theorem showing that purely analytical procedures are mostly ineffective in the study of a dynamical system. Although several of the features of chaos were known about at this time, they were not understood (1992).

More than a half of a century later three factors resulted in the explicit delineation of chaotic systems. First, with advances in computer technology, it became

possible to detail the effects of many iterations when solving equations. The next development was a realization that deterministic systems from simple equations could exhibit stochastic behavior. Finally mathematicians developed a better understanding of nonlinear equations, showing that these equations could produce chaotic behavior (Dresden, 1992).

The current interest in chaos can be traced to Edward Lorenz, a meteorologist at the Massachusetts Institute of Technology. Lorenz used a computer program to simulate the complex behavior of weather (Rockler, 1990-1991). As Gleick (1987) told the story, Lorenz's accidental discovery occurred in the winter of 1961 when the meteorologist copied a weather prediction program over to rerun it on a computer and then left to get a cup of coffee. Upon returning an hour later, instead of finding a copy of the old program he found that after a few months the simulated weather was completely different from the original pattern. He thought that a bad vacuum tube had caused the random weather patterns but then he realized that when he retyped the program he had used only three decimal places instead of the six stored in the computer. He had assumed that one thousandth of a difference was inconsequential. These small differences turned out to be catastrophic.

This phenomenon of small differences at the beginning which produced enormous differences over time was called the

butterfly effect by Lorenz. The analogy was the flapping of a butterfly's wings on one continent could cause a tornado on another continent by changing the atmosphere and the effect multiplying over a period of time (Gleick, 1987).

Predicting weather accurately for more than 2 to 3 days is hazardous but beyond 6 to 7 days is impossible. The reason for this unpredictability which Lorenz had stumbled upon is this feature of dynamical systems called the butterfly effect or sensitive dependence on initial conditions.

Lorenz began to focus on "the mathematics of systems that never found a steady state, systems that almost repeated themselves but never quite succeeded" (Gleick, 1987, p. 22). Nature has many such aperiodic systems. Lorenz saw a connection between the inability to predict the weather accurately and its unwillingness to repeat itself. If the weather repeated itself, it would become boring. "To produce the rich repertoire of real earthly weather, the beautiful multiplicity of it, you could hardly wish for anything better than a Butterfly Effect" (p. 23). Small differences in initial conditions can be exaggerated over time in life as well as in science. Ott stated that "exponential sensitivity of chaotic solutions means that, as time goes on, small errors in the solution can grow very rapidly (i.e., exponentially) with time" (1993, p. 16).

Thus the future of a chaotic system becomes difficult to predict.

Stewart's (1989) recipe for chaos called for phase space and initial conditions that stretch and fold repeatedly. His real world analogy for a recipe for chaos was the stretching and folding process used to pull a candy like taffy, folding--stretching, folding--stretching. Complex dynamical behavior increases from steady to periodic to chaotic.

Chaotic systems are systems that are very complex with wild, turbulent, and random behavior (Ott, 1993). Yet within that disorder patterns are found. Within the regions of chaos are orderly intricate structures (Gleick, 1987). Some patterns of chaos are thought to be universal. Patterns are not specific to certain examples but could represent whole classes of systems (Stewart, 1989). Order and chaos have a special kind of balance (Waldrop, 1992).

Fractals, a characteristic of dynamical systems, are smaller copies of the same structure on a scale. Mandelbrot, cited in Stewart, came up with the term "fractal" to describe geometrically an object that continues to show detailed structure over a large range of scales. Stewart (1989) stated that "an ideal mathematical fractal has structure on an infinite range of scales" (p. 217). An example of a naturally occurring fractal is a coastline.

Strange attractors are another characteristic of chaotic systems. In a dynamical state these strange attractors are the areas toward which all nearby solutions gravitate. A general dynamical system settles down to an attractor over time (Devaney, 1990).

Rockler (1990-1991) summarized chaos theory in nonmathematical terminology with these propositions.

1. Chaos theory helps to explain the nonlinear aspects of the universe.
2. It bridges the determinism of the Newtonian model with the randomness of quantum physics. It does so in part through the concept of the "strange attractor."
3. Chaos theory demonstrates that small changes at the beginning of a system can lead to major differences at the end.
4. An understanding of chaos results in the perspective that the universe is an open system.
5. Significant human systems can best be explained by chaos theory. The nature of the human body and weather forecasting are two recent example. [sic] Education is still another system to which chaos theory can be applied. (p. 60)

Chaos Theory in Complex Systems

Chaos theory has important implications for solving practical engineering problems. McRobie and Thompson (1990) related the 1974 disappearance of a trawler off the coast of Norway in heavy seas in which 36 people died. An investigation revealed that there was nothing wrong with the ship's design which met all capsizing and stability standards. One possible reason for the disaster was that a quick series of large waves hit the ship broadside. This is called a transient phenomenon. Oddly enough, techniques utilized by engineers to determine stability assume that the vessel is not moving. At the inquiry naval engineers indicated that those methods of design might not be adequate. Engineers often assume that nonlinear dynamical systems are linear for the purpose of design; it is usually a good approximation. McRobie and Thompson contended that "the linear approximation is usually worst when things are about to fail" (p. 42). The application of chaos theory to engineering may allow engineers to predict what the authors refer to as a "blue sky disaster." "The most far-reaching benefit of applying chaos theory to engineering is that it is helping us to understand nonlinear dynamic behavior in real situations" (p. 46).

Doyne Farmer, Norman Packard, and James McGill formed the Prediction Company. This company used chaos theory for yet another purpose, to predict stock market prices

accurately enough to be profitable. They used mathematical techniques based on the regular patterns that occur in complex systems. By using chaos theory, Farmer and company looked at part of a pattern to infer the next element in that pattern. Chaos studies do not look at cause and effect because the response is not proportional to the cause. As cited in Berreby (1993), Farmer stated "It would be surprising if the stock market were linear. Just as almost all animals are non-elephants, almost all physical phenomena are nonlinear" (p. 78). Packard proposed that chaos science has predictive power because it observes the overall pattern of change itself.

Another interesting use of chaos theory involved its possible application to the aging process. Lipsitz and Goldberger (1992) suggested that chaos theory may provide a new framework for understanding aging. They "propose that aging can be defined by a progressive loss of complexity in the dynamics of all physiologic systems" (p. 1808).

Anatomical structures including neuronal dendrites and bone trabeculae exhibited some decreased complexity with aging. Heart rate variability, blood pressure variability, pulsatile thyrotropin release, and electroencephalographic evoked potentials are physiologic systems which also experienced decreased complexity with aging. The range of audible frequencies was another area of loss.

Saperstein (1990) discussed the utilization of chaos theory to model international security policy. Policy makers need models to predict the future outcomes of current events and procedures in order to choose the best procedures to use to obtain the desired outcome. They need to foresee the unpredictable. The use of a linear model (cause--effect) is no longer appropriate in a world where international events are so complex and nonlinear. Policy makers are looking to nonlinear dynamical models.

The emerging science of chaos was also applied to the Mayaguez Crisis. The U.S. merchant ship Mayaguez was seized by Cambodian naval forces on May 12, 1975. The reason for the seizure was not readily apparent and there was great concern for the safety of the crew. A plan of action was developed from incomplete, inaccurate, and conflicting intelligence (Mueller, 1990).

Rational, predictable behavior which characterized most diplomatic operations was violated by the actions following the Mayaguez incident. Mueller (1990) contended that there is a stable range of expectant behavior in the Gaussian distribution but that there is some percentage left for chance or luck. The range of expectant behavior is where most incidents occur. In the international political arena the reactions between countries should fall within this range of expectant behavior. Chaos theory addresses

incidents beyond the range of expected behavior where small changes can cause huge effects.

According to Mueller (1990), the Mayaguez seizure precipitated a series of events that were in the range of exceptional behavior and could not have been predicted without using chaos theory. He further maintained that the unusual national setting in the mid-1970s along with other factors contributed to a unique environment that lent itself to chaos theory analysis. The benefit of this application of theory to the incident is for application to future situations. Perhaps chaos theory could provide a better method of dealing with political crises.

Yet another use of chaos theory has been identified by Heppner and Grenander (1990) in the simulation of a model for the coordinated flight formations of small birds. The model simulated a leaderless bird flock utilizing the stochastic nonlinear equations of chaos. Synchronized behavior in turning, initiation of flight, and landing typical of different bird species has been simulated.

Kellert (1990) reflected on the philosophical implications of chaos theory. He considered the implications chaos theory might have on the concepts of impossibility, orderliness, intelligibility, and determinism. Another question he posed concerned whether or not the world's course of development is unique given the unpredictability of chaotic systems. The emergence of chaos

theory reflects a world less confident and certain of itself. Farney (1994) proposed that the effect of chaos theory on nature was like a gale at the window rearranging scholarly thought.

Chaos Theory in Business Organizations

There is a demand for a new worldview and new kind of thinking to deal with turbulent unpredictable organizations and their environments (Morgan, 1993; Stacey, 1992; Wheatley, 1992). Traditional markets, industries, and countries disappear while decentralized flat organizations, new information, and new technology restructure the world. Some management thinkers have looked to the new developments in science for ways to cope with the rapidly changing world.

Quantum physics, cybernetics, chaos theory, cognitive science, and Eastern and Western spiritual traditions provided the basis for a new paradigm or worldview (Rose, 1990). This new worldview requires a new way of seeing and understanding business beyond the industrial age. During the industrial age numbers were all important, professional management expertise was paramount, and control was top down. The new worldview sees businesses where people (employees and customers) are the focus, the structure is a network, and the emphasis is on interconnectedness. The impetus for a new worldview came from the need for swiftness

and a combination of deregulation, corporate takeovers, and the fall of the Soviet bloc.

Morgan (1993) also proposed a new worldview. The theoretical base for his book on organizational management came from what he called the postmodern worldview. This postmodern worldview paralleled the new science of chaos, paradoxes, and the changing nature of order and disorder. A postmodern world requires a more fluid, self-organizing form of theory and practice for organization and management.

The postmodern worldview questioned the old rational linear thinking based on careful control and planning. Today's managers are assaulted by unexpected influences that change the most careful plan. They must learn to creatively deal with constant change while nurturing productive initiatives that develop from the surrounding events and disorder. Morgan (1993) called the kind of thinking required by current organizations as "imaginization," the art of creative management.

Bailyn (1993) described the new worldview of organizations with chaos theory terminology by using descriptors like dynamics freed from order and predictability, exciting variety, and liberated systems. She also noted that the butterfly effect has particular resonance in today's organizations. This effect, also known as sensitive dependence of initial conditions, means that small organizational decisions hidden and embedded in

ordinary practices can cause huge problems later in organizations.

Three principles were envisioned by Bailyn (1993) for the new chaotic organization. The first principle was that the meaning of time and commitment needed to be reevaluated for people in organizations. Second, organizational assumptions about career continuity, uniform employees, and careful definitions of jobs must be reevaluated. The last principle envisioned suggested that the link between the organization and the employee should be loosened while the link between public and private life should be closer. Bailyn's three principles represented a patterned but more chaotic view of organizations.

Another example of new science influence on business organizations was modeled by a health care conference in Utah which was designed to apply chaos theory to organizational management.

Prather and Lazar (1994) described this "future search" conference which was dedicated to improving the quality of women's health care. Individuals from all levels, functions, and stakeholders of healthcare were represented. They included doctors (obstetrics, gynecology, family practice, internal medicine, geriatrics, pediatrics, psychiatry), nurses, midwives, and representatives from alternative care, hospital and women's centers, health and liability insurance companies, medical practice managers,

HMOs, managed care, university providers, private practice, medical research companies, healthcare media, and healthcare consultants. Participants were asked to review the past in women's healthcare by bringing an object they felt represented this care. They were asked to define recent decades of healthcare and responses were recorded on Post-it notes and placed on the wall under the relevant category. Present responses the healthcare system is now providing and problems that persist were added. Utilizing the past and the present the conferees created action plans for the future of women's healthcare. The design, "future search," was taken from whole systems planning and was intended to foster creative thinking.

The design was controlled chaos. This was not a typical conference. There were no speakers, participants seemed confused and frustrated, walls were covered with notes. The purpose of the conference was to force thinking out of the comfortable range and into a creative, productive range where solutions could be found (Prather & Lazar, 1994).

Chaos theory may be a valuable tool for describing corporate performance patterns. This hypothesis was proposed and tested by Priesmeyer and Baik (1989) as they described quarterly patterns of performance for Toys "R" Us, Inc., Tandy Corporation, The Toro Company, and 17 other publicly traded companies. Quarterly sales and profits for

all companies from the first quarter of 1974 through the third quarter of 1988 were analyzed. Limit cycles were plotted from this data and software programs were developed to compute and display the histories. Almost every company displayed a limit cycle which behaved as a nonlinear system.

Priesmeyer and Baik classified each company's data in relation to chaos as period 1, 2, or 4. Results indicated that period 1 companies (the Limited and Schlemberger Ltd.) probably have a stable industry or are good at dampening environmental shocks. Period 2 companies such as Toys "R" Us, Inc., and Wal-Mart Stores, Inc., experienced yearly oscillations reflecting proportional change in performance. Tandy and Hechingers produced period 4 patterns representing controlled chaos with potential to become unpredictable chaos. The researchers proposed that chaos theory could provide a new management tool which would deal with changes in performance rather than summative reports. Some managerial decisions may produce unpredictable results (butterfly effect). The researchers reported that chaos analysis revealed a new domain for research and had wide-ranging potential for studying businesses. They also concluded that behavioral measures such as absenteeism and employee turnover rates could be analyzed using chaos theory. They further concluded: "Although it is new to both practitioners and theorists, chaos analysis deserves

further investigation to explore its possible application on the performance of business organizations" (p. 47).

Chaos theory was also applied to business in an analysis of organizational growth in technology-based ventures (Eisenhardt & Schoonhoven, 1990). In newly founded U.S. semiconductor firms the characteristics of the founding top-management team, the strategy, and the environment were related to sales growth. Results of this analysis indicated that the effects of the founding team and the effects of the environment grew over time. The gap between large and small ventures widened and semiconductor businesses expanded with time. The researchers noted that this finding resembled the butterfly effect characteristic of chaos theory in that small, or chance, advantages when beginning a new organization can multiply and become amplified in a positive-feedback system.

Kiel (1993) asserted that chaos theory may provide a means for assessing the systems theory of organizations. He analyzed employee work activity data from a government agency. The purpose of his study was to present chaos theory as a method for analyzing public administration and to present the use of tools of chaos theory to analyze systems concepts in organizations. Effort was calculated per employee, per minute of labor cost, and for each category of activity. It was concluded that people in organizations represent dynamic systems and should be

analyzed accordingly. He recommended chaos methodology to expedite the evolution of a science of public administration because it provided new insights into the management of organizations.

Chaos theory has also been used to understand the stock market crash on Black Monday. Chaos theory was characterized as being in its infancy in the social sciences. Hector (1988) asserted that the effort to use chaos theory to devise formulas to predict the stock market is years away, if possible. William Brock, an economist, as cited in Hector stated: "as yet chaos theory doesn't do anything for you formally. But it gives you inspiration for models and helps you think through ways to solve problems" (p. 76). The butterfly effect provides intriguing insight that a violent shift in the stock market may have resulted from a tiny change in one variable.

In her book about organizations and the new science, Wheatley (1992) discussed the theoretical application of chaos theory and other scientific discoveries to organizational leadership. She proposed that new discoveries in science, including chaos theory, contained images, metaphors, and perspectives that might inform organizational theory.

Wheatley (1992) defined chaos as a system's final state away from order. "Chaos . . . is created by iteration in a non-linear system, information feeding back on itself and

changing in the process" (p. 125). She purported that chaos provides a source of creativity and should be appreciated. All systems have the potential for chaos.

The best organizations have a fractal quality of behavior at all levels. There are guiding principles or values which influence the behavior in organizations because those behaviors were patterned at the start. The fractal patterns teach about the importance of qualitative measurement--that the shape of the system and how it develops and changes is what can and must be known. Quantitatively it is impossible to know and measure all of the information about a system in enough fine detail to eliminate the butterfly effect and make it predictable. Wheatley (1992) said the message from science for organizations is to focus on whole systems and gain enough perspective to influence them. Wheatley also proposed that organizations should look for themes and patterns rather than cause-effect relationships.

Further, Wheatley (1992) continued, leadership is communicating guiding visions, strong values, and organizational beliefs. The application of chaos theory to organizations is a matter of keeping a clear purpose and direction rather than hands-on control, while simultaneously creating flexibility and responsiveness. Chaos should be expected and right answers should not. Wheatley further

asserted that we must become comfortable with uncertainty and confident in confusion.

In his organizational management book Stacey (1992) proposed that chaos theory and self-organization may be used to develop a unique approach to the management of business organizations. A brief summary of his application of chaos theory to these complex systems follows.

Stacey (1992) contended that the life expectancy of an organization is about half of a human life span. Two thirds of the companies which were named "excellent" companies were no longer on the list 5 years later. Further, an organization which is successful over a long period of time is not one that is moving toward stable equilibrium.

The knowledge of nonlinear feedback systems which generate unstable behavior comes from mathematicians and scientists. Stacey (1992) maintained that "all business organizations are nonlinear feedback systems" (p. 12). He proposed adopting a new mind-set for managing organizations or nonlinear feedback systems. His propositions are paraphrased here.

1. Long term future is unknowable and unpredictable.
2. Managers must focus on constantly changing agendas.
3. A strong unified culture prevents organizations from being adaptable and flexible. It is better to have multiple contradictory cultures.

4. "Learning groups of managers" in "self-organizing networks. . . encourage open conflict, engage in dialogue" to deal with strategic issues.

5. Conflict between the bureaucracy (structure of the organization) and networks of people produce change.

6. The decision making process comes from "experimental, exploratory processes based on intuition and reasoning by analogy."

7. Control comes from group interaction rather than rules, and system control is a result of "learning activity in a sophisticated group of people."

8. "Innovation and new strategic directions, however, require the development of new mental models--new maps--for each new situation. No person, no book, can prescribe systems, rules, policies, or methods that dependably will lead to success in innovative organizations" (pp. 13-15).

Mental models determine whether managers are able to deal with the unknowable. Stacey (1992) asserted that current mental models concentrate on "order, stability, cohesion, consistency, and equilibrium" but that not enough attention is being paid to the "irregular, disorderly, chance nature of the game" (p. 21). Today's models are based on the beliefs that successful organizations strive for stability; that the installation of certain techniques of systems can insure success; that strategic thinking is analytical; that strategy is a regular design which results

from intent; that control is negative feedback; and finally that innovation is the result of loose flexible structures and shared power.

The game is unpredictable and full of surprises and the winners will be innovative players who understand the dynamics. "The game is dynamic, interactive, and nonlinear, . . ." (Stacey, 1992, p. 26). He continued, there is evidence that a linear approach will not be successful. Four principle lessons can be learned from the dynamical systems model.

First, the structure of the system influences behavior. In this sense the system has a life of its own,

Second, complex human systems often produce unexpected even counterintuitive results. (p. 33)

Third, in complex systems the links between cause and effect are distant in time and space. (p. 34)

The fourth lesson of systems dynamics is that complex systems are highly sensitive to some changes but remarkably insensitive to others. (p. 35)

Stacey (1992) insisted that an organization is creative only when it operates in a far-from-equilibrium state of chaos where endless variety produces creativity. He described chaos as a "combination of order and disorder in which patterns of behavior continually unfold in irregular but similar forms" (p. 63). He advised managers to look for

qualitative patterns of chaos rather than quantification. Choices should be made using reasoning and analogy instead of analysis.

Chaos theory provides a mental model for successful business organizations, Stacey (1992) continued. A nonlinear system balances one set of forces pulling a system toward stable equilibrium and another set of forces pulling it toward instability. The successful organization operates between these states in an area called bounded instability.

Stacey (1992) discussed the self-organizing aspect found in all human systems which is also evident in business organizations. He cited the networking of contacts between individuals as just such an uncontrollable, invisible, self-camouflaging, self-organizing system.

Thinking from a nonlinear systems perspective provided three significant insights. One insight is that problems may be due to the complexity of the system--not a particular person. Second, an individual may make an enormous contribution due to exponential amplification of small differences in chaotic systems. The final insight is that group participation and perspective sharing are vital due to the complexity of these systems (Stacey, 1992).

In conclusion, Stacey held that a "dynamic system perspective recognizes the importance of contradiction and creative tension between the clear-cut, rigid forms of control required to handle the knowable, and the self-

organizing forms of control required to handle the unknowable, both of which operate simultaneously" (1992, p. 184).

Chaos Theory Applied to Social Systems

The literature dealing with chaos theory and social systems is limited. The order and patterning used in social life is similar to the concept of order found in quantum physics, chaos theory, and modern biology. Regularity is sought but not uniformity and predictability (Dobbert & Kurth-Schai, 1992). Certain characteristics of chaotic systems are like characteristics of social systems and there are significant implications for social science research (Gregerson & Sailer, 1993). Chaotic social systems are depicted by discontinuous, unexpected, or unpredictable change.

Perna (1992) rejected the Newtonian linear causal models upon which psychological and psychoanalytic thought have primarily been based. She maintained that all the assumptions of the meaning of human behavior have been premised on these linear models which may have lead to erroneous conclusions. Chaos theory, in contrast, deals with the behavior of systems in the act of evolving. In Perna's dissertation, chaos theory was used to inform the study of human psychological functioning.

Blackerby (1993) explored the application of chaos theory to psychological models in an effort to improve the understanding of human beings and human behavior. The contention was that most contemporary psychological models do not attend to the metaphysical conditions found in human systems. Further Freudian, Jungian, and behavioristic viewpoints are deficient because they assume a closed, linear system. Blackerby also asserted that human systems are open, nonlinear, and self-organizing, all characteristics of chaotic systems. Blackerby in this dissertation used a sample model utilizing simulated data for the mathematical relationships. "These emergent patterns provide a significantly better model fit to the dynamic reality of psychological behavior" (abstract).

Gregersen and Sailer (1993) developed mathematical models of chaotic social systems but admitted that perhaps they were farfetched. They contended that there were implications of chaos theory for social science research. First, reliance on cross-sectional studies will not reveal and model chaotic aspects of social systems. Second, poor analytical results should be expected when standard statistical methods are utilized on chaotic systems. Also, the use of simulation techniques to study complex social systems was recommended, however a real system cannot be modeled. A further implication was that statistical technology will play a useful but different role in studying

chaotic systems. Another insight was that qualitative methods of analysis will become increasingly important. Finally, the aim of research when analyzing chaotic systems was understanding--not predicting.

Stickel (1993) contended that chaos theory furnishes an interesting framework from which to investigate the process of counseling. Chaos application to counseling focuses on the becoming (growth and change) aspect of counseling rather than getting to a fixed status. It also provides for behavior that may be random and unpredictable yet is part of a patterned whole.

Chaos Theory and Educational Systems

Cronbach (1988) observed: "Educational events have always been far more complex than our research methods, and the success of natural scientists in handling some of their messiest problems should inspire and perhaps instruct us" (p. 46). Researchers in education conventionally used a paradigm that utilized two or more variables and following data collection the variables are tested for linearity. Linearity indicates a relationship between the variables. However, scientists who study chaos maintain that the steady state or linear part of a system's pattern is relatively small. To understand how the system functions as a whole a nonlinear model would provide a more accurate representation. Lindsay (1989) further noted that although

a nonlinear model for analyzing educational phenomena may not be developed, the chaos model can be used as a metaphor for looking at complex systems. Peca (1992) asserted that chaos theory provides other ways to look at and study reality.

Research on chaos theory and educational systems is limited. One study conducted by Blair (1993) attempted to assess the usefulness of chaos theory to functioning administrators and to assess whether or not this theory would be appropriate for preparation of educational administrators. The researcher utilized a formal process of critical ethnography to conduct the study.

Blair (1993) collected narrative data in an effort to determine the pertinence of chaos theory to the practice of educational administration. She contended that chaos theory may have potential for a holistic approach to the administration of education. A failure to think holistically could result in ignoring seemingly insignificant elements.

The research team for this study was made up of five principals, three graduate assistants, and Blair. The data were collected from narrative descriptions of daily experiences of the administrators. Observations and interviews were also conducted by the university members of the team. Five principals were involved in the study. Each

case study dealt with an apparently insignificant incident that became a very large scale problem.

Each situation was then analyzed by posing questions that might reveal a relationship to chaos theory. Standard questions asked of all cases follow.

Question 1 - Could this incident have been avoided?

Question 2 - Should it have been avoided?

Question 3 - How damaging are the effects, in the short term and the long term?

Question 4 - Are there positive effects as result of the incident?

Question 5 - When consistent positives are weighed against projected long-term negatives, what is the balance for the short term and for the long term?

Question 6 - Might the incident have been avoided by a well-informed chaos-conscious administrator? (p. 591)

These questions were used as the test criteria for analyzing chaotic situations. After a year's research a survey was sent out to assess the principals' understanding of the material studied. Blair (1993) concluded that whether or not the administrators were able to use theory to enhance practice is a question that requires more research.

Another examination of chaos theory and its utility for educational administration was of an exploratory nature and

was conducted by Griffiths, Hart, and Blair (1991). The concepts of chaos theory which were examined included the butterfly effect, the onset of turbulence, dissipative structures, random shocks, strange attractors, recursive symmetries, and feedback mechanisms.

Griffiths et al. (1991) analyzed a case study in retrospect by applying concepts of chaotic system models to a situation in which rapid growth and change occurred in a school district. Centerville Unified School District was studied for a 5 year period. In applying chaos theory to educational administration in this school district, the authors conceded that their effort was "quick and dirty" due to the post hoc analysis and limited data. This qualitative study produced data that were not collected with a chaotic model in mind. While the concepts of chaos theory are appealing, they predicted that careful planning will be required to identify chaos in social systems. Their study did not reveal an overall patterning with which to provide a long-range analysis of this social system. However, the researchers were both hopeful and skeptical of applying chaos theory to educational systems. Hopefulness stemmed from the "intuitive and explanatory value for fundamental and important research issues in educational administration. Many of the aspects of chaos theory appear to help scholars and practitioners understand outcomes" (p. 450). Skepticism

was a result of a lack of precise quantitative measures required to examine chaotic systems.

Guess and Sailor (1993) examined the implications of chaos theory for special education and students with developmental disabilities. Chaos theory has received little attention from the behavior sciences and almost none from special education. A conceptual model based on the application of chaos theory to understanding schizophrenia has considerable relevance to the development and testing of dynamic modeling paradigms for children and youth with disabilities. This would include, especially, the applications of chaos theory of new models for assessing and treating the many syndromes and conditions (e.g., autism) that display complex, dynamic interactions between organic and environmental variables and conditions. The application of chaos to investigate more discrete behaviors common to numerous types of disabilities is another logical extension for practitioners and researchers in our field. (pp. 29-30)

Holayter and Sheldon (1994) asserted that too many times school leaders in a nonlinear world are expected to be caring but competent, tender but tough, and sensitive but strong. At the same time they must deal with pressures of high expectations, social problems, crises, violence, and low test scores. They also maintained that applying small

forces to nonlinear systems can affect chaotic behavior.

The butterfly effect aspect of chaos theory had particular significance for an experienced superintendent who stated that he paid attention to details and looked for truth in even the most unreasonable complaints instead of waiting for the large effects to occur (Jones, 1994).

Jones (1994) purported that one reason for the increased interest to educators in chaos theory is their propensity for searching out the latest theory which might help them explain and perhaps manage unmanageable systems. She quoted Wheatley from a telephone interview who stated that she had found

a lot of the issues we end up dealing with when we are in this fire-fighting mode, when looked at over time, reveal a much deeper systemic issue. If we dealt with that one, we'd get out of the craziness of these small but very inflammatory crises. (p. 22)

CHAPTER 3

Methods and Procedures

Chapter 3 addresses the methods and procedures that were used to investigate in school systems the characteristic of chaos theory called sensitive dependence on initial conditions or butterfly effect. It contains descriptions of the population, the sample selection method, the data collection procedures, the data analysis, and the external audit.

Population

The population investigated for this study was principals with 5 years of administrative experience. Principals were chosen because they operated from a strategic location in the central level of school systems. This location provided a perspective from which to observe local effects of decisions made at the district, state, and national levels of school systems. It also allowed principals to witness the consequences of decisions or behaviors beginning at the lower levels of school systems, the school levels. These consequences may have occurred at the central office, on the school board, in the press, or even in the courts. Experience was a requirement for selecting principals. Time was needed for consequences of some decisions or behaviors to produce effects within a

school or school system. For example, the impact of state or federal decisions, or school board policy changes may not result for years.

Twenty-seven principals shared their time expertise to discuss unique perspectives and experiences with this researcher. Purposive sampling to maximize variation was used. Participants were drawn from three moderate sized city locales in three different states. The various geographical locations among Tennessee, Virginia, and North Carolina also provided geographic diversification. This sampling produced data from three states and four school districts. Principals in the Knox County School System in Tennessee, a unified city and county school district, with a combined city and county population of 335,000, participated in the study. Principals in the Roanoke County School System in Virginia where the combined city and county population is 190,000 also participated. The city system in Roanoke declined to allow principals to participate in this research. Principals in the Asheville City School System and the Buncombe County School System in North Carolina where the combined city and county population is 175,000 also participated.

Purposive sampling was further designed to provide data from various configurations of schools within these systems. Six high school principals, 6 middle school principals, and 15 elementary school principals were interviewed. Within

these three school divisions, grade configurations of K-2, K-3, K-5, K-6, 3-5, 4-5, 6-8, 7-12, and 9-12 were included.

Data Collection

A modified critical incident technique (Flanagan, 1954) was used to gather data for this study. The interview segment of the critical incident technique was conducted using the long interview method (McCracken, 1988).

Sample Selection Method

Before beginning the data collection process, access to the school systems and to the principals was obtained. The means to access varied depending upon the school system approached. Acquiring access to two of the school systems was obtained by receiving verbal permission by telephone. Access to three of the school systems required submission of select information about the study and also required a personal interview with the appropriate central office personnel.

Close proximity to a higher education institution and consequently the number of research requests received by a school system may have been considerations for determining access requirements. Three schools' officials stated that they received many requests to conduct research in their schools and, therefore, had to consider them carefully. One assistant superintendent remarked that their system was

adopting a policy that research must directly benefit their school system before it would receive approval.

The issue of access is an important matter because without it the study cannot be conducted. According to Eisner (1991)

access is a delicate matter. We need the consent of those we study in order to do our work. They ought to understand, as far as we can explain, the aims of the research and how the study is to proceed. They ought to know what they, as people who provide consent, may expect as an outcome of the work. (p. 172)

After permission was obtained from the school systems, access to the principals was acquired. Principals or their secretaries were contacted by telephone and permission was obtained and appointments were made to conduct interviews. Most principals graciously and generously provided their time and knowledge for the interviews. Only one principal of those contacted declined to be interviewed. Interview schedules were set up and an introductory letter was sent to principals (Appendix B).

Data Collection Procedures

The primary data collection was accomplished using the critical incident technique. The critical incident technique was utilized and refined by Flanagan (1954) at the American Institute for Research and the University of

Pittsburgh during the 1950s. Flanagan's critical incident technique was also used for studies in the United States Army Air Forces in World War II to derive procedures for the selection and classification of aircrews. Several studies directed by Flanagan in the Aviation Psychology Program used this technique to provide an analysis of reasons for failure to learn to fly, reasons for failure of bombing missions, the problems of combat leadership, and disorientation while flying. More recently the critical incident technique has been used by Edwards (1993), Reich (1994), and McGurk, Platten, and Gibson (1994).

The critical incident technique included a group of procedures for collecting important facts concerning human behavior in specific situations. These procedures were made up of five steps:

- (a) Determination of the general aim of the activity.
- (b) Development of plans and specifications for collecting factual incidents regarding the activity.
- (c) Collection of the data.
- (d) Analysis of the data.
- (e) Interpretation and reporting of the statement of the requirements of the activity. (Flanagan, 1954, pp. 354-355)

Stano (1977) maintained that the main advantage of the critical incident technique is that it provides data based

on actual behavior rather than inferences, stereotypes, or subjective estimates. Flanagan (1954) asserted that

it should be emphasized that the critical incident technique does not consist of a single rigid set of rules governing such data collection. Rather it should be thought of as a flexible set of principles which must be modified and adapted to meet the specific situation at hand. (p. 335)

He further asserted that the critical incident technique involves simple types of judgments from the observer, reports from qualified participants, and an evaluation in terms of the stated purpose of the activity.

Critical incident technique procedures were used for collecting observed incidents having special significance and meeting specific criteria (Flanagan, 1954). In this study the special significance and criteria were that the incidents in school systems be ones in which the behaviors or decisions seemed insignificant when they occurred but produced relatively large consequences. Flanagan recommended four means of collecting critical incidents: personal interviews, group interviews, questionnaires, record forms, or some combinations of procedures. The method of data collection for this study was the personal interview. The aim of the interview was to obtain stories or anecdotes of "critical incidents" which illustrated the butterfly effect, or sensitive dependence on initial

conditions characteristic of chaos theory. The interview technique was chosen for this study because the intent of this method is to learn from people--not gather data about them (Spradley, 1979).

Subsequently the data collection via interviews was conducted. Spradley (1979) recommended that the purpose and direction of the interview be made clear. He stated that there are two processes of interviewing: developing a rapport with the participant and getting information from the participant. Strauss and Corbin (1990) held that the purpose of questioning is to open up data. The critical incident technique (Flanagan, 1954) was used to collect and analyze this data from incidents reported by experienced principals. Flanagan preferred collecting data from current or very recent experiences. Using incidents from principals' past experience was a variation from Flanagan's technique. This modification was sometimes necessary due to the time needed for the effects of some decisions or behaviors to transpire.

Flanagan (1954) recommended that gathering critical incidents should begin before the researcher has completed a literature review. Given the requirement that a literature review be completed prior to dissertation research, this recommendation was not followed for this study.

To conduct the interview segment of the critical incident technique (Flanagan, 1954), the modified long

interview (McCracken, 1988) was selected. A part of the long interview is the questionnaire (Appendix D). As this study evolved it was determined that the structured questionnaire did not help establish rapport or facilitate participant discussion. Therefore, the researcher adopted a less structured format (Appendix D). The topic of discussion was introduced by the researcher and rapport was established with the principals. A specific and rigid set of questions was replaced by a less formal discussion of the purpose of the study and the nature of the incidents that were being solicited. Permission was received to record all of the interviews except one. Recording data allowed the researcher to concentrate on the statements of the participants. Once the principals began recounting incidents, the questionnaire was not strictly followed. The questions were usually answered during the relations of the stories. Also, interrupting the flow of the dialogue did not prove productive. Notes were taken during the untaped interview and transcripts were typed of the other 26 recorded interviews.

The long interview method was selected because it deals with the content and pattern of experience by reaching into the mind of the individual to see the world from his/her perspective (McCracken, 1988). Spradley (1979) referred to this tapping of cultural knowledge as "getting inside their heads" (p. 8). Another advantage of using the long

interview method was that the interview provided access to individuals with desired knowledge and experience without a prolonged intrusion into their lives. Finally, the amount of time and attention which professionals can devote to an interview is a consideration for both researchers and participants.

Principals were the qualified participants because they deal with all levels of school system operation and because they had 5 years administrative experience. During the interviews the researcher solicited critical incidents from principals. The researcher's intent was to treat all participants with respect and appreciation. Therefore Guba and Lincoln's (1989) recommendations for dealing with human subjects were observed during the interviews:

Inasmuch as an evaluation involves humans (as clients, as stakeholders, as information sources, and in many other ways), it is incumbent on the evaluator to interact with those humans in a manner respecting their dignity, their integrity, and their privacy. (p. 10)

Prior to conducting the interview principals were presented with and asked to sign the standard ethics protocol (Appendix C) adapted from McCracken (1988, p. 69). At the beginning of the interview a general introductory statement was made concerning the aim of the study and the rationale for choosing principals as participants. Principals were told they are uniquely positioned and

especially well qualified to observe the effects of decisions and behaviors in school systems. These "experts" deal concurrently with and in close proximity to the people who make up all levels of school systems including school board members, superintendents, state administrators, building level faculty and staff, students, parents, and community members.

As the interviews progressed the principals, who were accepted as experts on the incidents, were given instructions regarding the nature of incidents to report (Appendix D). The potential for researcher bias was noted due to the preponderance of negative effect incidents reported and the nature of the original questionnaire. The participants were asked to reflect on their experience in schools systems and to recall incidents. This procedure of using recalled incidents was consistent with the original critical incident technique because Flanagan (1954) cited some use of this method to collect data regarding specific actions involving decisions and choices. These critical incidents depicted behaviors or decisions which seemed insignificant when they occurred but produced relatively large consequences.

Flanagan (1954) wrote that it was reasonable to assume that the use of recalled incidents would provide satisfactory data. He reported that memory would improve if participants know in advance the experiences to be

remembered. Therefore interviews for this study were conducted after an introductory letter was sent to the prospective (Appendix B) participants. The introduction explained the purpose of the study and the nature of the questions to be asked during the interview.

A minimum sample size of 50 to 100 incidents may be a satisfactory number according to Flanagan (1954). However, there is not a formula for determining sample size. Data from the 27 participants provided incidents from three states, four school systems, and 27 schools. In an effort to make the process as convenient as possible for the principals, the interviews took place at the schools where the principals were working. The interviews were scheduled during the normal working hours for principals, most of them occurring during the student day.

The anonymity of the participants and the information that was collected were protected by the investigator.

Data Analysis

After collection, data were analyzed and summarized to increase the usefulness of the information. Patton (1990) stated that due to the uniqueness of each qualitative study the analytical approach will also be unique. The analytical approach used in this study was a modified critical incident analysis (Flanagan, 1954). The critical incidents reported provided the raw data for the analysis.

Data analysis was begun after transcripts of initial interviews were received and continued as data was being collected. The first process of data analysis was data reduction. Incidents of the butterfly effect were extracted from the transcripts, summarized and written on index cards in accordance with the critical incident technique.

Factors were derived in the next stage of analysis. This subprocessing or categorizing was completed to classify incidents (Flanagan, 1954). Incidents were coded on the top line of index cards according to the area of schools and school systems involved. Cards were then sorted into factors of schools and school systems involved in the critical incidents. The sorting is a critical step which requires "insight, experience, and judgement" (Flanagan, p. 334). The sorting into categories is analogous to conducting a factor analysis (Stano, 1977). Miles and Huberman refer to them as "recurring patterns, themes, or 'Gestalts'." (1984, p.216) Eisner (1991) also recommended the distillation of data into major themes to provide structure for writing the analysis and within this structure to select material to illuminate these themes.

Flanagan (1954) stated that the categories should cover all incidents of significant frequencies. He further recommended they be logical and their titles or summary statements should convey meanings in themselves. Flanagan also advised that titles should be neutral and of the same

general magnitude. Six factors of critical incidents were identified from the data. Factors included curriculum, discipline, extracurricular activities, personnel, school community, and transportation/facilities. Summary cards were also coded according to the level of origination of incidents. State/national, school district, school level, and classroom level were used to code index summary cards on the bottom left corner. Additionally, cards were coded according to whether or not the incident was the result of a decision or a behavior. This code was placed on the bottom right corner of the card above the principal's name. Transcripts were referred to during the coding process. Cards were resorted depending upon the research questions and data needed. Transcripts were utilized throughout the analysis for clarification and verification of incidents and reporting data.

Another set of incident summary cards was written. This set of cards included the incident summary and all subsequent ripple effects of each incident. Ripple effects were analyzed for patterns or themes.

Due to sample size, purposive sampling technique, and descriptive nature of the study, no attempt to generalize findings was made.

External Audit

An external auditor was selected. Dr. Carolyn H. Brown, Associate Professor at King College in Bristol, Tennessee, and Director of Institutional Assessments, agreed to serve as auditor. Dr. Brown has taught graduate level research at East Tennessee State University, Tusculum College, and King College where she teaches the statistics and research sequences of courses. She also works on a private basis as a data consultant for doctoral students and was well-qualified to conduct the audit.

Meetings were arranged with the auditor beginning on June 13, 1995. During these meetings the audio tapes and typed transcripts of the interviews, data analysis working documents, data presentation, a calendar displaying the dates of the interviews, times, and places and other pertinent details were left with the auditor. The auditor was asked to provide validation of the interviews, their transcriptions, and use of quoted material in data presentation. Also the validation of the identification and categorization of the critical incidents and ripple effects from raw data were requested.

With only a few minor differences, the auditor confirmed the validity of the tapes and the accuracy of the hard copy transcriptions (see Appendix E). The auditing process reflected no major discrepancies between the actual words of the participants, the hard copy transcription, and

use of quotes from the interviewees in data analysis. Congruence was found between the raw data and incidents, between incidents and categories, and identification of incident ripple effects.

Summary

This chapter addressed the method for investigating the characteristic of chaos theory called the butterfly effect as it operated in schools and school systems. It contained a description of the population of principals and the rationale for choosing them. The critical incident technique was utilized to collect data. The interview segment of the critical incident technique was selected. The method of data analysis was described. The external audit and the auditing processes were included.

CHAPTER 4

Presentation of Data

The purpose of this chapter is to address the research questions concerning chaos theory and the butterfly effect in schools and school systems and describe incidents of the butterfly effect in schools and school systems.

Research Questions

The data from interviews were used to answer research questions. Incidents communicated by principals were related exactly as told to the researcher. Unless participants' grammatical mistakes created confusion, they were not corrected. An exception to quotes verbatim was ones that could potentially identify schools or systems that participated in this study or lengthy episodes which were abbreviated. Their confidentiality was protected by inserting generic terms for specific names, schools, or school systems in the transcripts. The researcher's additions were added to quotes for clarity and were placed in brackets.

Flanagan stated that an incident may be deemed critical if "it makes a 'significant' contribution" (1954, p. 338). Since principals were considered the experts in this study, their judgments concerning whether or not an incident was significant were honored.

Research Question 1

The first research question, can the butterfly effect be identified in school systems?, was answered affirmatively. The characteristic of chaos theory known as sensitive dependence on initial conditions or the butterfly effect was recognized by principals who described it in school systems. The butterfly effect was characterized in various ways by the principals. One high school principal portrayed it by repeating some advice he gives his "people."

Ma'am, I have a saying that my people here are well familiar with. It's much easier to spit on a match than to try to take a flat snow shovel and beat out a forest fire when you are getting your ass burned. So let me say this to you. It's the rivets that keep the planes and the ships together. When the rivets start coming out, you're looking for disaster so it is the very little things that you should be aware of. Big things never get you. It's those little things that you just don't seem to have time to deal with that you push off to the side of the desk, that you forget about. Those are the things that will in fact grow and grow and pretty soon, consume you. It's like a skin cancer. Melanoma appears about the size of a pinhead to start with and if it's not carefully looked after, immediately it's certain death.

Previous experience with the butterfly effect influenced principals' decision making. Another administrator described dealing with the butterfly effect in schools as a balancing act.

When someone asks me to give my top five jobs, I always say my mind is like a little balance scale. That's what an administrator's job is, you are weighing everything. You are trying to weigh every decision you make from the front end. And things that you have a tendency to think are just tiny little insignificant things always have the potential to be great big things. So, I mean, there's probably just about a million of those that I could start citing off.

Yet another principal elaborated on the universal nature of the potential butterfly effect, of small decisions and how they may affect school systems. He stated that "any day in [sic] any given decision can be fit into that category. It is something that folks do not really clearly understand, the responsibility that a principal has." Another principal confirmed the incidents in school systems. "They're there. You just kind of have to kind of deal with them as they come up the best you can." This principal added, "I think anybody you talk to, whether it's a first-year principal or somebody who has been there for quite a while, has examples of these kinds of things [that] just don't follow the path you think they're going to."

Another principal reflected that the lack of predictability of working in schools was an aspect of a principal's job that made it interesting. He remarked that such nonlinearity had implications for the characteristic of flexibility. He affirmed:

The best part about the whole situation is this is nowhere near a linear deal. If it was we could plan, we could put in our head this will happen, but you can't do that. One of the best things a principal has to be is flexible. You have to be able to go with the flow and kind of look out. You need to plan, you need to look at where you are ultimately heading, but the road you take to get there may be completely different.

Another principal reiterated the consideration she gave to decisions due to the occurrence of the butterfly effect in schools and school systems. She stated:

We try very hard to take [a] look at a problem before we do something about it for the very reason you mentioned [butterfly effect]. Once you make a decision, if it is indeed the wrong one or not the best choice, you spend a lot of time trying to at least come up with some kind of compromise that you can live with.

One principal declared: "Nothing was little. You never knew what was little and what wasn't. I think in human activity sometimes, it's the multiplier effect." The

butterfly effect was a consideration for another principal as part of the decision making process. He affirmed:

I think I try to be aware of even positive decisions that there's always going to be a change on the other end. And I try to be aware. I can't always foresee, but I try to think in terms, if I make this decision at this time what would happen on a broader basis. Would that become policy or whatever? And I really try to approach things by looking at it from that perspective but that's not always possible.

An elementary school principal described how the butterfly effect worked in her school and produced satisfying outcomes:

So you just have to fight harder for evening that gap when you're in a school like this one by going outside the school and hoping that the whole village will educate the child. Because, if you don't have that support, you have nothing for these kids in comparison to what other children have. So sometimes you think, "Well I'm just making a drop in the bucket." But what we have found is happening is that once you make one little drop, then you pursue another little place. You've made another little drop, and finally you're putting the focus on the school, and people really are then beginning to want to help. Sometimes you think, "Well I'm not going to get anywhere." And things just

arise out of something you had no idea it was going to arise from. So I guess what I'm trying to say, sometimes you plant these little seeds and you don't think they may go anywhere but sometimes it returns itself to you a lot more than you thought it ever would. Where, you thought this is going to be minuscule, this is not going to be important.

The butterfly effect aspect of chaos theory in schools and school systems was described by principals. This characteristic of chaos theory influenced principals' thinking about decision making and planning. Some principals related how they had taken advantage of the butterfly effect to improve their schools.

Research Question 2

The second research question asked, are there factors or categories of critical incidents which can be discerned in school systems? Data from principal interviews produced six factors of schools and school systems which had produced butterfly effects. Curriculum, discipline, extracurricular activities, personnel, school community, and transportation/facilities were the six factors in these school systems which exhibited sensitivity to initial conditions or the butterfly effect aspect of chaos theory.

As research question 2 is addressed, this section presents six factors of the butterfly effect incidents in

the schools and school systems. Data from interviews illustrating each factor are presented. These factors are presented in order, curriculum, discipline, extracurricular activities, personnel, school community, and transportation/facilities.

Curriculum. School curriculum emerged as a factor of butterfly effect incidents from the interviews. Twenty-five percent of the incidents narrated by principals were curriculum related. Principals reported various areas of school curriculum which in their experience exhibited the butterfly effect. These areas of curriculum included censorship, curriculum content, grading scales, length of the school day, scheduling, site-based management, teaching methods, and textbook selection.

Censorship was an aspect of the curriculum from which principals recalled incidents that produced considerable effects. One principal mentioned ghost stories in books on the library shelf produced objections which, if strong enough, have large effects. Another principal described a censorship situation he was dealing with:

I had a parent who complained about some materials in the library book. And those procedures set to, by which you review materials and make a recommendation, that actually is in the process right now and has not been resolved. The parent who complained said, "I

don't want to make this a big issue, I just want to get rid of that book." My position is well, you can't make that decision because you're just one person and we've got a procedure to follow. And he said, "That doesn't make any difference. I'll do everything I can to see that that book disappears from all Doe schools, if it is in anybody else's school." And so we are probably going to lock horns over that down the road a little bit because he wants me to censor the book and I won't do it. And that has potential for a real big ugly thing, but I hope not.

Grading scale changes developed into a controversy concerning lowering standards. The issue of grading and its relationship to performance was also an issue for a middle school principal. In addition to grading scales, scheduling was an aspect of curriculum which exhibited the butterfly effect in schools and school systems. Decisions to utilize block scheduling and decisions not to utilize block scheduling produced disparate situations for schools. Block scheduling was described by one principal as something that should have been a simple decision but escalated into an issue with everyone:

And I guess it goes on. We're wrestling now with a four period day. We are presently on a seven period day and five schools in our [system] are on a four period day where they have 90 minute blocks. That's

kind of interesting, too. We are holding out for a seven period. We have five 50 minute blocks where they go to 90 days. And there is a real edge here, gosh, they are getting (a four period day is getting) 145 minutes total per class and we're getting in, oh I don't know exactly, I guess 170 hours of instruction in. Where they're getting in 135 hours of instruction.

Even that decision has parents involved, has the board of education involved. You would think it would be just a simple decision that is made in the best interest of the kids here on site, but it is amazing how it affects everyone. And we are presently a seven period day to stay there and let other folks work on this four period thing and let them iron out all the wrinkles before we jump in on it. There are some things that bother us, so that in itself is another big issue.

Celebration of holidays and the resulting conflict with the religious beliefs of students and their families were butterfly effect scenarios for several principals. In one situation parents were very upset when a Menorah was used as a decoration in school. Another principal anticipated difficulties from a second grade Halloween musical production:

This occurred this year and we tried to do a lot with student plays and student musicals and something that

we had all been looking forward to was the very first musical of the school year. And it just so happened to be at Halloween and the musical was going to be [title included witches] and it was using second graders. The day before this was presented, we were going to take the whole student body to the auditorium. It never crossed my mind that anybody could make anything out of this. I just thought it was wonderful. The entire second grade class was going to participate in this.

Before, I can't remember exactly what day Halloween was on, but the day before that--I have a good many [certain religious group] here--children and they don't celebrate. It's never a big issue during parties, during Christmas, during Halloween, they don't participate. Parents come and get them and we always try to downplay Halloween. That's a real lively topic in our area, witches and things like that, and we know not to make a big thing out of it.

The day before we were to view the play, three parents came in and they were very adamant that they did not want their children to participate in any way with any activities to do with Halloween. And they told me their philosophy and they went through all of this. Never once did the three parents who came in and were so adamant about their children not participating

in any activities, they didn't once mention the play especially since it had a witch in it.

The way I handled that, I came back the next day and put a memo to the teachers rescheduling the assembly program for Tuesday, that was on a Monday. And I said due to the challenges that I have received and in order to be fair to everyone, all children wishing to see the second grade Halloween musical must have a signed parental permission slip. Those students having a signed parental permission slip are welcome to see the play on Tuesday, November 1. That worked out fine but some of the parents also did not understand why I was responding to the other group of parents. Two parents got real angry. They said I don't know why my child has to have a permission slip to go see an innocent second grade play and so I listened to them and just let it die down over the days and months. But I knew a big thing would be made if we made everybody go in there. If we said okay everybody will be going to the program, I knew having those three challenges prior to that, I knew what was coming. So, it was just an innocent second grade program that was really made into a pretty big thing.

In summary, the curriculum factor of schools and school systems produced 25% of the incidents reported by principals, more than any other factor. Aspects of

curriculum that produced butterfly effects included censorship, curriculum content, grading scales, length of the school day, scheduling, site-based management, teaching methods, and textbook selection.

Discipline. Discipline was another area that generated exponential effects in schools and school systems. Twelve incidents of discipline which resulted in excessive consequences were recollected by principals. "I think probably more of those [incidents] come from issues dealing with discipline than anything else because with discipline you are walking a very fine line. What you say can and will be used against you," declared one high school principal.

A middle school principal described what he perceived as the changes in dealing with discipline issues in school systems now compared to years in the past:

I think the general concept of discipline, and this is universal, this is not just our school system or inner city or anything. Everything has changed tremendously and you know that as well as anybody. Because when I first went into teaching and administration, you know most of your office referrals were kids who were playing hooky from school, or who kept chewing gum against the school rules, or maybe sassed a teacher, or cheated on a test.

And now you know what the situation is. When I first started disciplining kids, whatever discipline meant, I'd say 95-98% of my discipline problems were between me and the child. It was handled between me and the child. Now, I would say as a principal at least 75% of my discipline problems will wind up, maybe 85% will wind up, with a conference, at least a conference with me and the parent involved. And sometimes it is just the parent simply saying I want, you know, my kid told me this. What's the real story? All the way to a direct challenge and threats of lawsuits. My child can do no wrong type stuff. It is changing a lot and the types of offenses are horrendous.

A decision by a student can precipitate very large effects in school systems. While recounting this discipline incident one principal attributed the situation to a student's pride. He reported how such an incident escalated at school:

Oh, I can think of another situation that occurred. And we had a student who had a problem on a school bus. And I always put myself out in the parking lot when the buses are being loaded to go home in the afternoon. And this bus driver pulls over and says, "This student would not sit in front of the bus like I instructed him to." And the student, I had already put him off the

bus one time before. And I went to [the] student and asked him to sit up in front of the bus, and he even refused me. So I told him if he didn't go to the front of the bus, then I was going to call the police and to have the police to put him off the bus. And he still refused until the police arrived. They came on the bus. He voluntarily came off the bus with them. He was off the bus again for weeks because of that. Plus his parents had to converse with me about the problem. And he still wonders whether I'm going to charge him for trespassing because when he didn't go off I said, "If you don't come off, I may charge you for trespassing." So his daddy being a former student of mine, I simply told the daddy that I was going to make him wonder whether I was going to take him to court or not because of that. But the boy instead of just simply going to the front of the bus, like he was supposed to, because he had before had caused problems, chose to go through all of this. And the reason I'm sure is because of his pride. He wanted to show the other students that he was going to stand up to the bus driver and the principal. And he lost in the long run. Because he's still off the bus.

This principal also related the effects on students who refused to remove hats in the building and refused to obey dress codes. These students either complied with the dress

codes or were sent home. Several principals maintained that discipline probably produces more butterfly effect incidents than other areas. One of them made this point:

But particularly when you're dealing with problem kids or any special education kind of student and what you're doing with those kinds of kids. We've got a rule right now [that] if you're caught with a weapon like a gun [you are] expelled from school. So now you got two kids--one special ed., the other non-special ed., but both bring a gun to school. One is kicked out for the rest of the year and the other is back in the classroom. The teacher says, "Wait a minute. What's going on here? I don't understand what happened." And then the parents get all upset. Like I say again simple, simple thing.

Racial tensions compounded the effects of an incident in the discipline factor especially when parents became involved. An escalating situation was described by a middle school principal:

Well, you know, you can think of situations and we don't have much racial difference here in our school for the most part. We are a school made of white students, you know, with about five or six black kids. But sometimes it seems like if there is, even with that small of black/white ratio, a problem that, you know, where a couple of white kids have an argument, it

probably wouldn't amount to anything much but sometimes if it is a black kid and a white kid, then that seems to have a domino effect on pulling other people in and knocking other people down, you know what I'm saying. It really seems to blow into a bigger thing than it normally would and I don't know if that's a societal kind of issue or whether that's a middle school kind of issue. But when you are dealing with situations like that, it seems to, I think, get blown out of proportion at the middle school level.

And I think a lot of that is because [of] the middle school level. And I think a lot [of] that is because the middle school kids are so intent on peer relationships and that sort of thing. And they constantly want to be identified as on one side or on another side. And you have got a lot of want-to-be kind of youngsters who want to be a part of a group and want to be a part of another group and something can happen.

Well, recently we had a situation where a young man who I would term, if you had to characterize him, I am just going to go ahead and say, kind of rednecky, social background. And words between he and a couple of black kids and then the dynamics of that gets a whole bunch of his buddies and a whole bunch of the black kids' buddies and then they are all going at each

other. And then you get this parent support more on the redneck side of casting all the blame on the other side. And that's the kind of thing you can sit and work for hours and hours on, you know, trying to come to some sort of resolution on it. And had it not been a racial kind of thing and maybe had it not been kids at this age that so identify within their peer groups, that I doubt very seriously that it would have gone into the proportion that it went into.

It wasn't like a riot or anything like that but I mean it's something where I, as an administrator, met with all the parents involved. I had counselors come in, or my counselors, not outside, but my guidance counselors making sure that we did all the mediation kinds of things that we needed to do and letter writing and everything, trying to get the situation sort of balanced back out. So that was a situation that I think under different circumstance wouldn't have gone as far as it did.

To summarize, the discipline factor in schools and school systems included 12% of the incidents reported by principals. Discipline incidents involved student behavior, teachers managing student behavior, staff modeling behavior, parent involvement with discipline, and principals administering discipline.

Extracurricular Activities. Extracurricular activities evolved as a factor in schools and school systems that manifested sensitive dependence on initial conditions or the butterfly effect. The extracurricular factor incidents made up 11% of those recounted by principals. Extracurricular activities including athletics, cheerleading, yearbooks, honor societies, along with school colors and mascots were recounted by principals as exhibiting butterfly effects. One middle school principal dealt with a yearbook issue in which the effects were far reaching as the incident was disseminated by worldwide news agencies:

I was at one time a sponsor of the school yearbook back in City Z where I taught a long time ago. But the sponsor had used a quote from Karl Marx in the yearbook. It was an innocuous not very significant quote but the next thing we knew it had been picked up by all the worldwide news agencies and a really big to-do made of it and of course the school principal got into a struggle over censorship. He was backing the teacher and her choice to use that quote because it was an appropriate quote. But there were all these folks out there waving flags and saying that this shouldn't be. For a very short period of time, it didn't last very long, but for several weeks there was just this major flap. And it was carried in major newspapers and news agencies and so forth.

Two high school principals related incidents which evolved into sizable issues concerning cheerleading. This extracurricular activity was an emotional one for participants and their families. One high school principal described an incident which began with a decision to dismiss cheerleaders from the squad. The sponsor disciplined squad members and the incident spiraled into an issue absorbing the principal, the superintendent, and the school board, touching issues of professionalism, authority, and parental rights.

Another interesting problem we had not too, too long ago was with our cheerleaders. I'm not supposed to ever deal with cheerleader problems. They're not mine. They're somebody else's problems. I deal with other things. Right? Wrong! But we had a rainy, rainy Friday night football game and it had been raining pretty well and our kids have ponchos, clear, plastic ponchos which they wear and the cheerleaders wear and it's okay. Well, a couple of the parents decided they didn't want their girls out there cheering so they pulled them off the squad and took them home. That's something you don't do with the squad, pull a member off the team. The cheerleader sponsor's rules were well, you're pulled off the team and you leave during a performance then you're off the squad. I really thought it was perfectly reasonable.

So she came in the next morning and she explained to the athletic director what she'd done. Then they both came in to see me and explained what they had done and I supported their actions. That was the end of it. There would be no more problem. Wrong!

So then they went to our director of personnel. Director of personnel called me and he concurred with what we had done, it was appropriate. Parents still weren't happy. So then they went to the superintendent. The superintendent talked to me, talked to the athletic director, talked to the coach. He concurred that we'd done the right thing. Then they demanded to be heard by the school board. They went to the school board with their problem. And the school board said, "You will put those girls back on the athletic team. You will put them back because we don't agree with the decision, what has been done." Well, that has turned into one of the biggest fiascoes you ever want to see. And it has just snowballed to the point where basically right now it's just here. The teacher is threatening to quit. She feels like her authority has been undermined. The superintendent is in a difficult situation. It's just proven to be something I've spent multiple, multiple hours on this with her. It's one of those things where I wasn't supposed to be spending any time on. But just a little

incident of parents pulling their kids off the team during a game to go home and the school board eventually turning our decision around. There's no way to expect that to happen.

Selection of students for participation in chorus, drama clubs, and honor societies produced out of proportion effects. One principal described the effect of selection of students for cheerleading and the volatile emotional issue cheerleading became:

And you advertise and promote your selection of cheerleaders and someone doesn't get selected. And the next thing you know, you have lines drawn and people get angry, people calling school board members. Things which cause cheerleading sponsors not to ever want to do that anymore. And race has entered the picture. If you have a certain percentage of minority students then you have to have that percentage represented on the cheerleading squad. But for some reason or another cheerleading is a volatile, emotional kind of thing. I think that most of the girls would rather be cheerleader than Miss America. Mothers would like that as well and so it becomes one of those huge gigantic issues wherever it surfaces.

Athletics became the center of a controversy for a student, his high school football coach, the athletic

director, and the state. The episode was related by a principal:

I can remember one other, another case that happened to me when I was an athletic director, which became a monumental problem. And I was only athletic director at the time, but I was also coaching football. And we had already played for the state football championship at Doe school and won.

And we had a student who was at the orphanage that played for us. And he had played a good game and gotten some publicity. Well this principal of another school recognized this youngster as a student who had not passed the eighth grade. He consequently because of semester rules and other rules was ineligible to play for us unbeknownst to us. We thought the youngster was all right. His records that we had gotten from [a school] had showed that he was alright. He had gone from one school to another school, to the home, to our school. All the records didn't follow him. Only the records from the school before that is what caused him to have the problem.

Well this principal recognized the boy and wrote, and called immediately and said, "This youngster's not eligible." So we went through a lot of stress trying to figure out whether or not he was eligible. And finally decided that he was not. And we had to declare

that the boy's ineligible and forfeit the state championship that we had already won. And another school in southwest part of the state became the state champions. Well we tried to counsel the youngster because he was remorseful. I mean he felt terrible. He thought he was eligible. He never dreamed he wasn't. He was just following what we had said. Well he left and just was gone for a couple of weeks. We didn't know where he was, what he was doing and it just got worse. Everybody was looking for him. And eventually he was found and the coach, our head football coach, kept him at his house because he wanted to be close to him to let him know it wasn't his fault, it was just something that happened.

But that's one thing that just started building up from one little thing that this principal saw that this boy was ineligible, until forfeiting a state championship and this boy running away. We thought he'd possibly had killed himself. He'd felt so bad about it. But that got to be a monumental [pause], and press, it was all over the paper and the boy saw this and it just became so much for him he just couldn't stand it and left.

In synopsis, extracurricular activities were a factor of schools and schools systems that generated butterfly effect incidents. Eleven percent of incidents reported

involved extracurricular activities including band programs, athletics, cheerleading, clubs, chorus, yearbooks, booster clubs, school colors and mascots, and honor societies.

Personnel. Personnel decisions and behaviors exhibited chaos theory's butterfly effect or sensitive dependence on initial conditions. Twenty personnel incidents in schools and school systems were reported that produced butterfly effects. Personnel issues included dismissing personnel, hiring personnel, principal-faculty relations, reassignment of personnel, staff behavior, teacher behavior toward students, and teacher complaints.

School personnel touch the lives of children on a daily basis. The vital significance of personnel decisions and their potential for influencing students were described by one principal:

I guess the biggest responsibility that I have is to put a teacher in every classroom that cares about children. And I certainly take all the training that I can to try to make sure that my skills are such that I can identify in 30 minutes, 45 minutes, an hour's time, someone that is going to be in the classroom eight hours a day. Possibly the biggest single influence in a child's life for some children who have difficult home lives and there have been a couple of times when a

decision I have made has come back to haunt me. I have chosen the wrong person.

Decisions regarding dismissal or transfer of personnel precipitated disproportional effects in school systems as well. Student walkouts, sit-down strikes, and protests with local news media coverage were some of the effects generated by personnel incidents. The dismissal of a teacher engendered such a butterfly effect. It was related by an inner city principal:

A year ago we got ready to dismiss a teacher and we were getting ready to dismiss this teacher and we had 3 years of documentation. We had a beautiful 4 inch file folder full of stuff to do it. Well, it came to the ninth hour, the eleventh hour, I should say, right before the time when I had to be down at the board and all of a sudden--the personnel issues you don't let anything out and you don't go around talking about personnel issues with anybody, private issue--but once this teacher found out what was happening this teacher decided that they would go out and talk about it because they had the right to do that if they want to.

Well, this happened to be an African-American teacher who went out and said how unfair we were etcetera, etcetera. Well, before long the kids picked it up and they're having a walkout in support of this teacher that they don't know anything about, except she

happens to be African-American teacher. And so the next thing you know, from where we're going, and we think it's a simple process that we followed through with, and we're going to take it to the board. We've got huge demonstrations. We've got student walkouts. We've got the whole bit happening, over what to us was a fairly innocuous kind of situation and just a matter of what to do. So that's one of those kinds of things that again was very simple straight walk that turned into massive problems and all kinds of meetings with people and the community meetings and meetings with kids.

Another principal described an incident which involved a personnel transfer and the effects it generated:

Well one that always comes to mind and did when you first called was a personnel situation where school board chairman, the superintendent of schools, and we concurred in changing band directors. The program was not going anywhere. He had been here for years and years and years and was pretty much floundering and we wanted better for the kids. And so we decided he would be transferred and we would look for a new person. And the lady we got is dynamic type person who has really done wonders with the program. But he had been here so long and was pretty much a fixture in the community and the school kids liked him. So when prior to the 15th

of April [came], I notified him that he was going to be moved and he might want to back down. And it just went all out of proportion. The kids went on a sit-down strike and gathered out here in the lobby, protesting. So we let them protest for a while and toward the end of the day let it run its course. Then they started again the next morning and I just wouldn't allow that. I got them in class. It was a lot of ill feeling around here for a while. But out of a simple personnel decision, simple move, that blew all out of proportion. The press was here, the TV cameras. This community is very, very supportive. I am very firm about doing things and running the type of school that we want and the community wants.

In summary, personnel decisions were reported that produced butterfly effects in schools and school systems. Twenty percent of incidents were from the personnel factor. Issues of termination or transfer of personnel produced effects including a student sit-down strike with extensive press coverage, student walkouts and demonstrations. Other personnel incidents involved desegregation of staff, personnel complaints, improper staff conduct, teacher conduct, site-based management, and parental concerns.

School Community. School community issues provoked disproportional effects in schools and school systems. Nine percent of the butterfly effect incidents recounted by principals were school community oriented. School community incidents reported by principals encompassed fund raising, business surveys, health matters, playgrounds, communication, and community projects.

Four of the school community incidents were health related. Head lice warranted front page news and television coverage for one principal. Health issues in schools and school systems are intertwined with and consequently affect public health issues. An incident which certainly became an enormous concern in one school community centered around a highly communicable disease. The principal shared this elementary school dilemma that started with one sick child:

Last spring, one of our parents came in and said, "Mrs. Principal, I hate to say this to you. We just found out today that my son who is in first grade has been diagnosed with shigella." I said okay. She said she was embarrassed and I told her not to be. I didn't know much about shigella. I knew it was diarrhea, but didn't know how it was passed or anything. She went on to say that the pediatrician who had diagnosed shigella had said he would have to call the health department because the Center for Disease Control would have to be contacted and she needed to contact the school because

we would probably be receiving questions. And we needed to be looking out for other cases of it and if other cases started appearing because it was so contagious we need to be aware of it.

That was on a Friday. I contacted central office to let them know. This media person just said be aware just in case you're seeing kids who are going home with diarrhea and all. You may need to let those parents know there's a possibility. Right now, we're just going to play it by ear and see what happens. So we made sure we had covered all grounds so far as state health codes and all. [Principal then contacted a local pediatrician for advice].

The next day we had a couple of kids come down with stomach cramps and had diarrhea. I immediately notified parents they might want to take them by their doctor and have them checked for shigella. That there were some specific tests that were involved and could not be diagnosed without that. That we did have a case in the school that had been reported and they needed to be aware of that. I again contacted the superintendent. But I would have the doctor help me write a letter to the parents in the event that we need to send home a letter about what the symptoms, etc.

On Monday morning, we had several kids that had to leave school with severe stomach cramps, low-grade

temperatures and severe diarrhea. And so we thought it was the point to send the letters home to all the classes involved.

The health department called that morning at 9:00 a.m. to say they had just had the fourth case from a private pediatrician. All the cases were students at Smith School and the other cases reported had connections to Smith School in some way. They said they needed to come by and administer rectal swabs to all the students in the first grade (there are six first grade classes). And they said they would be there in an hour.

I called the superintendent. He told me to stay on the line. He was going to a conference call and get Dr. Jones, who is the director of the health department. Finally, after about 10 minutes, he got Dr. Jones to back down and agree to put it off until the next day and so we needed to notify parents that afternoon. The letter that the pediatrician had written for us we went ahead and sent out. We also attached to it something about the testing for all the students in the first grade and that they had the option of going to their private physician but before they returned to school they would have to be tested.

The health department was sending over public health nurses and they would set up stations to do

rectal swabs. The first round they tested that day there was a high percentage that indicated there was some culture growth on these. They called the next day and said they were testing kindergarten and all of the multiage classes which were about 120 students. We had three fifths of our school tested the next day.

Parents went wild. Not so much about the shigella as the rectal swabbing. We as a school said they could be present with their child. It would be done in a very private facility. Many of them chose to be present. The media got a hold of it and went wild.

To further complicate matters, these media had a meeting with the health director which our school nurse also attended. The question came up about how could this be running rampant through a school, it must be other places too. One of the nurses said it could happen a number of ways: a class could be cooking, maybe making a trail mix, and not have proper hand washing and infect something else. The director of the health department made a statement he heard that possibly this had come from trail mix in one of the first grade classrooms. No one had made trail mix in any of our classrooms. That hit the newspaper. There was another uproar about what was going on. The only thing we could do was just sit back and make sure we were enforcing proper hand washing, that we were

informing parents what was going on and just abide by health department mandates. This lasted about a month.

Then when other cases started appearing so several schools were called. This started off very simple and parents were very angry that testing took place so soon. They were angry with the school system for allowing the health department to do this. We were saying that they had no choice. The Disease Control Center--you do what they say to do--we are a public entity.

For quite awhile, the shigella issue was discussed and cussed and everything. Parents were upset that the kids had been herded through the rectal swabs like cattle. One mother came in and voiced her displeasure that a stranger did the rectal swab. This child didn't know her; even though she was a nurse, his regular doctor was not present. All we teach about "just say no" and then the nurses were giving stickers and she felt like that they were teaching kids they should do anything for a sticker. We had a lot of repercussion.

Incidents manifesting disproportional effects within one school community were described by one principal as beginning with a drop in the bucket and a seed planted. "So I guess what I'm trying to say, sometimes you plant these little seeds and you don't think they may go anywhere but sometimes it returns itself to you a lot more than you

thought it ever would." This principal involved the school community in providing technology and a school community playground for this school in addition to this reading program.

Another school community experience began in an affluent community with just a question from a parent about how much money it would take to put computers in the classrooms. The principal described the incident:

I want to talk a little bit about a decision we made right at the end of last school year to try to raise money to put technology in our school. We live in a very affluent neighborhood and so we started. We had some incoming fifth grade parents who asked how much it would take to have computers in their children's classrooms for this year. We decided to have a fund raising effort, to really ask for donations from parents of those children to fund having the computers. Then we got into this and the whole school, parents from other grade levels said we would like to have it in our child's grade level too.

So we're finally deciding. Our eighth parent committee was formed during the summer. It was more or less me contacting some people, asking what they thought of the idea, would they like to form a task force to help us with this. So by the time school had started, we had this plan in place of what we were

going to do. We had already, in fact, purchased the computers for fifth grade. But we had a very ambitious plan to raise the money for all 20 classrooms in our school. So we have been more than able to reach our goal this year for the first phase of the program.

This incident was an example of a seemingly insignificant query from a parent that produced considerable effects. Those effects included the purchase of computers for fifth grade and the development of plans to raise enough money to purchase this technology for all classes in the school.

To summarize, the school community factor of schools and school systems produced 9% of the incidents reported. Health issues accounted for 44% of school community incidents. Fund raising, business surveys, health matters, playgrounds, communication, and community projects were areas of school community related that produced disproportional effects.

Transportation/Facilities. Eleven percent of the incidents which produced disproportional effects were from the transportation/facility factor in schools and school systems. Principals communicated butterfly effect situations in this arena of school systems. For example, a principal made a change in the traffic pattern around the school in an effort to make the area around the school safer

for children. She described the effect as enormous, "You would have thought the world was coming to an end."

There were relatively major reactions to changes made in an area as clinical as cafeteria seating. A surprised principal recounted the incident which resulted in a faculty all "bent out of shape":

The first year I came here I went downstairs and you were down there in the cafeteria and you saw how the tables were arranged. They are in little clusters with each class having an assigned section and the numbers are hanging from the ceiling. They had been used to that for the 3 years before I got here. I came from junior high school and we had tables in long rows in the cafeteria and I thought during the summer when I arrived, now I need to go down there and set the cafeteria up. So I did it that way. The teachers got bent all out of shape.

Cafeteria seating, actually the lack of seating, developed into a public relations problem for another school that was undergoing renovations. The principal pictured the predicament:

The biggest thing I remember in recent history is when we went through renovation about 4 or 5 years ago. The entire building was renovated. There was a new section built and we were able to move into it. But they didn't have the cafeteria completed in terms of

renovation. And we couldn't even get in there to sit on the floor or to put cafeteria tables up or temporary tables.

The construction company couldn't turn over the use of the facility until it was complete. It was a legal requirement. Liability was involved and so we had to do something as an alternate and we knew about this the end of July. It was something of a surprise because we had been promised we could use that as well as the new wing. We had to be creative and find something else to do since we weren't going to be able to use our cafeteria. But obviously we were going to need to feed the children.

There is one school in Doe county that serves children in their rooms on a regular basis, but they are set up with special carts for delivery and there is an area in each room for eating lunch. Part of what we were concerned about is being a renovated school and getting a \$3.5 million face-lift and making us a brand new school again. It was a 50 year old school. We had been infested with bugs, roaches, and we didn't want to stir that up again. So we didn't want to move into the new wings and the old wings that had been renovated with new carpet and start eating in the rooms without some proper precautions.

And so we discussed that at one point and we finally decided that there wasn't going to be carpet in the hallway until they had finished the cafeteria and that's one of the last things they put in because it is such a high traffic. And we decided that none of the renovation could get messed up by eating in the hallway and that it would be a good thing to do. We had problems, too, with how do you monitor. The state law says that teachers have a duty-free lunch and so we had our teacher assistants who monitor the lunchroom but they couldn't monitor three or four or five different hallways simultaneously. The answer for us when we all discussed it, that's PTO board members, faculty and I. We said the thing that seemed smart was to eat in the hallway but to sit on the floor. We'll put on the floor new carpet scraps or picnic blankets, or picnic tablecloths and make something fun out of it, just have a picnic until the cafeteria really opened. And so it was widely known. The PTO advertised it and we talked to all the key people. We talked to the room parents about it, talked to central office so they would know what we were doing, so it would not be a surprise to them.

Apparently we talked to everybody in creation in our community except two people who when they saw it happen or when the children came home and told them

they were eating on the floor. The parents took that to mean the children were not only sitting on the floor, but the food was somehow directly on the floor. Like sandwiches were sitting on the floor where children actually walked, which was not the case. And so instead of calling us--and I still don't [know] to this day why they didn't call us to ask us about it--they called the newspaper to investigate and the newspaper did [not] come out and investigate. They went ahead with the parent's story without investigating and so it was in the newspaper the second day of school.

Then all the TV stations picked up on it and decided to come out too and see what we were doing to abuse the children. And when they all arrived, including the newspaper people, they saw what we were doing was reasonable and normal. And that we had checked with everybody and these two folks had not checked with anybody. They should have checked their sources. And they were very apologetic and the next day in the newspaper, did a follow-up story about how much fun the children were having. And that we were literally having a picnic on the grounds in the school and that we never heard anything back from the video media. They didn't do any follow-up story to say things were okay. Those just had to stand and so we

finally got through all that but it was one of those things where we thought we had taken care of all the bases and yet it still there was the opportunity for something to go wrong.

A decision by a school district to cut the transportation budget instead of classroom funds precipitated the butterfly effect for their system. A principal recollected how this decision affected one school:

I might talk about transportation a little bit. At the beginning of last school year, that would be the '93-'94 school year, well actually during the summer of that year, we implemented new policies for the buses. For elementary schools if you live within a half mile of the school then you are not eligible for bus pick up. They redrew the routes. They cut out a lot of stops, attempted to make things, they cut a lot of money, and attempted to make things more efficient. What happened was really very chaotic at the beginning of the school year and I guess this goes against what you're asking about. It started out as this huge fraggle and now it's sort of died down. We still have some problems but it was like it was going to run us for the year. That was all we were going to be able to accomplish for the year. We had a lot of people who were very, very upset about it.

To summarize, the transportation/facilities factor generated 11 butterfly effect incidents. Principals recalled incidents from this factor that included condemned property implications, building renovations, design of facilities, bus route and schedule changes, rearrangement or placement of equipment, and changes in traffic patterns.

Non-Categorized Incidents. Eleven incidents were not categorized in a factor. Those incidents and some nonspecific incidents are addressed in this section. Principals expressed trepidation for some nonspecific incidents. Twenty-two of these nonspecific situations were related by principals but not included in the analysis of incident data due to their general nature. The researcher considered insights and perceptions about the butterfly effect in schools and school systems informative even though some were not included in a factor and some were nonspecific incidents.

Many schools dispense medicine to students everyday. The potential for an intolerable consequence is ever present. An inner city high school principal related fears about the dispensation of medicine by school staff:

It starts out with one parent saying my child needs a pill at 11:00 o'clock and then it escalates and mushrooms and before you know it you have a regular pill schedule with kids coming to the office on a

regular basis, a daily basis and you're giving them pills. The [secretaries] give narcotics, they give Ritalin, they give Prozac. They give all the kinds of things that the children have to have to function.

These people are not trained to do this kind of thing. It is an infringement on their rights to have them do this stuff. But they do it. They don't complain about it and I live in constant fear that a medicine is going to be switched one day. They are very careful. Everything is labeled. We keep stuff under lock and key, but I just live in constant fear that one of those little pills is going to be switched one day. And I think my God what's going to happen to us?

Special education was another area of concern related by several principals. One principal lamented one effect of special education laws. "It saddens me to think that I talk to people on a daily basis who say to me, 'My desire is to get my child certified so that my child can have these special kind of services.'" Principals were struggling with issues of cost, inclusion, discipline, providing teacher in-service, appropriate student placement, and services for children. One principal discussed the implications of the special child and the large impact on school systems:

Another program, our special ed. and our inclusion programs that we have going on, you have so many

different levels of student needs. And many times you only have a certain number of staff. And while the problems may vary and increase, your staff doesn't. Maybe your funding doesn't. So you have to look at creative ways. You have to look at how can I approach this problem differently in order to better meet the needs of that child. I find that phase of education taking up more and more of my time and energy. I'm not upset with this from the standpoint that I believe it's extremely important. It's just very difficult to work these out.

The potential for the exponential effect from a decision made by M-teams for special education students was expressed by principals. One principal related the diligence required when formulating M-team decisions:

I guess really then if we had to talk about the kind of things that you really need to weigh very carefully, that's some of the material out on IDEA and 504 and the decisions that we make in M-team meetings and writing IEPs and all of those kinds of things which impact us daily--treating children as individuals, meeting individual needs. All of the legal ramifications that are there, all the confidentiality, considerations that we have, the decisions about placing children in different classrooms. That has come back to haunt me at times. Teachers have strengths and weaknesses.

Teachers teach from a philosophical base and if your philosophical base is not such that they really believe in things that need to be done, then you are in big trouble. If they don't believe, really and truly, that it's really an injustice to treat kids who are different the same, if they don't really believe that, you are in bad trouble trying to carry out an IEP and do the things you are legally bound to do.

Principals also expressed concerns about the exponential effects involved with school discipline. A middle school principal remarked that a routine discipline situation could escalate into a major problem in which all kinds of statements, facts, figures, and depositions were required. Another concern about discipline was parental defense of students' bad behavior and the resulting conferences, direct challenges, threats of lawsuits, and hours spent defending discipline.

To summarize, the factors of incidents in schools or school systems which principals related as having disproportional effects included personnel, curriculum, discipline, school community, and transportation/facilities. Other incidents not classified in a factor included site-based budget decisions, special education, racial comments misconstrued, and promotion-retention. Principals expressed concern for nonspecific but information rich occurrences of butterfly effects.

Research Question 3

Research question 3 concerned the origination of butterfly effect incidents in schools and school systems. Research question number 3 was stated: Is the butterfly effect precipitated at the school, district, state, or national level of school systems?

The level of school system operation which precipitated the butterfly effect was identified from principal reported incidents. The butterfly effect incidents originated at all levels of school operation including national, state, district, and schools.

State and National Levels. The state and national levels of school systems precipitated only 4 of 100 incidents depicted by principals. Incidents precipitated at the state and national levels involved regulations governing special education, an increase in high school graduation requirements, and a mandated duty-free lunch for teachers.

District Level. Incidents beginning at the district level of school systems totaled 19% of those reported. Seven of the 19 were curriculum issues and included school system consolidation, site-based management, textbook adoption, curriculum alignment, and the length of the kindergarten school day. At the district level five incidents dealt with transportation/facilities matters such

as open space classrooms, reduction of transportation budget and subsequent modifications, and rapid growth of a school. Four of the 17 involved personnel factors and pertained to site-based management, voluntary staff desegregation, and personnel transfer.

One principal attributed the following district level situation that occurred 4 years later to the "arbitrary fashion" in which a desegregation plan was implemented:

Well, I think that one of the things that, I guess I would first discuss the desegregation plan in our school system. I think that it was a voluntary plan and I think it came about because there were some problems. There were a lot of separate issues that they addressed and one of them was staffing issues. Now we have a plan where there is at least one minority on each staff and before that this was not true. You cannot have all black faculty. You cannot have all white faculty and the same with the student body.

Well, what happened about this decision was that teachers in schools that had no minority staff members were paired as it were and a lottery system with teachers and staff that had all black or majority black. And so about 1990 these people had to trade places. That sounds like a sort of simple [decision], but we're still seeing the fallout from that. It was done one summer.

Now it was, one of the problems that occurred is that this was to take care of half of the staffing and they were going to do the other half the following year. But they did not. I'm not sure who made the decision not to do the other half the following year. The people who were forcibly transferred, unwillingly transferred, they had to stay where they were for 3 years, or resign. That was their choice. So you had some very, very unhappy people.

And the news this week is full of a situation that occurred because of that. The parents have pulled their children out of school, the parents in the classroom. They're making this big. They're threatening a lawsuit and all kinds of stuff. So that has been problematic. Yes, they needed to desegregate our staffs, but doing it in that arbitrary fashion did create a set of problems that we are still paying for, I think.

School Level. Seventy-seven of all incidents reported originated at the school level of school systems. Sixteen curriculum incidents were school level incidents and dealt with curriculum content, scheduling, grading, teaching methods, celebration of holidays, and censorship.

The following curriculum incident was cited because it produced an exciting curriculum program in which teachers

and students learned together and then taught others. It resulted in a learning experience for the entire school. The outcome involved the implementation of a dynamic computer program. This curriculum incident was described by the principal:

We had [been] going to a ASCD conference in Washington in March a couple of years ago and we went to one session on the Hypercard and we were really intrigued by it and decided we would like to do something with it. The Hyper Studio was published and that's more for elementary children, much easier to do than Hypercard. So it was just like, this is going to be it, and then once we decided we were going to have this program as part of my total program. That's when Jane decided she would like to use this model that we had talked about with the teacher and the students learning together with the students becoming instructors along with the teachers.

When we did the dissertation research with Jane Doe, we worked with the Hyper Studio program. We had a fourth grade teacher and four students, a fifth grade teacher and four students, and a sixth grade teacher and four students. And they became teams, three different teams, that worked on teaching the children how to do the Hyper Studio program which is a multi-media approach. And then those students became

instructors for other students. And we were able then to instruct the entire grade levels in a real quick manner. We have been able to use that model all along. They create their screens just like they're writing programs and put their art work in and we have a scanner and they can scan pictures from books or photographs. We have a camera. They can video tape something and integrate that into their program. That's probably the latest big thing we have done. Those are energizing things. It creates a certain amount of chaos.

I didn't have the space or an extra classroom to do this. When we were doing the training on the Hyper Studio we had to set up the library as a classroom. We hired a consultant to come in and initially teach it. We served the children breakfast. We worked all morning and then we had our little luncheon, and just like they were off at a staff development class.

We did this for a number of days and then when we had to sit down and decide how to bring some closure to it, we decided to have a dinner. So we invited all the parents and had the cafeteria fix dinner. Then we did some demonstrations to explain what this project was all about. And then the students took their parents to the computer and tried to teach them the Hyper Studio. It was at that point the parents had a full realization

of how dynamic this program was and how complicated it was.

Discipline incidents originated primarily at the school level. Effects of incidents in the discipline factor resulted in the development of a student advisory council at one school and the creation of a black student advisory council at another school. At the school level, one principal produced significant improvements in discipline at her school. This incident was precipitated by trivial discipline referrals to the principal. She portrayed the transformation:

Another area that we have had some real good things come out of some bad things was in the area of discipline and behavior. I was having a lot of trouble years ago with teacher sending children down for every little thing. It was driving me crazy because all I was getting done all day was taking care of somebody who didn't have his homework, he was chewing gum, he was talking back to the teacher. And I sensed that the teachers thought I had nothing to do so they needed to keep me busy. And there were select teachers around the building doing this.

But I decided that we would develop a discipline behavior plan. It was a lot of record keeping initially but in the process of doing that, we also began using as many materials as we could find on

pro-active management skills. We had a lot of growth in that area. But they began to manage these problems without having to involve me. Not only did it get a better handle on the discipline in the building but it was an impetus for growth on the part of the teacher and improving their management skills in a positive way.

All of the extracurricular activity related butterfly effect incidents originated at the school level of school systems. Principals' accounts included concession stand revenues, school colors and mascots, yearbooks, honor societies, clubs, bands, and cheerleading. Extracurricular activity incidents were recalled for 11 incidents. One principal was striving to avoid the impact of a potential butterfly effect incident. The following example characterized by a high school principal illustrated the thought processes he engaged in, in an effort to prevent the exponential effects of a band program. He was disturbed about potential community ramifications:

The band director has commissioned a team of composers from somewhere up North and they, they're focusing on the theme at Gettysburg to be a program for the band to perform when they march in competition and at half-time of games and those kind of things.

Well, what is this music and the little blurb and I only have a window of maybe 15 to 20 minutes for this

idea to be presented to me and then all of a sudden this band director, he wants an answer. Can we go or can we not? Now he presented it to me, he said well in this program "Dixie" will be played, a confederate flag will be used. But a union flag will be used and other musical scores, "The Battle Hymn of the Republic," and on and on and on.

There is the spinoff of the movie "Gettysburg Battle" and how important it was to the South and to the North. They are trying to ride this wave of popularity. So, you know, I am asking Mr. Doe, I am saying, "John, what, how will "Dixie" be used in this?" You know we're a school in the middle of this Bible Belt. There is all kind of strong opinions left and right and a majority of our population would not be concerned about it, but we will have that percentage of our population that it would be very traumatic to, you know.

So John, how will it play, how will it go? Tell me, are you going to raise rebel flag and go screaming down the band field and with this thing and participation by the audience. Well, he assures me that it will not be used in that way. The score of the music is such that the band will be on the field and marching and it will be a reenactment. The band will be divided in half and the movements will be such that

there will be this confrontation that will veer from low to high and eventually the flags will fly together in unity and the North and South. The South losing and the North now being as one and the battle, the Civil War, actually ending. So anyway we went on and on and on, and I have yet to make a decision on that. But uh, I am real concerned about what kind of spinoff problems I'll have from that.

Personnel incidents were reported with 15 beginning at the school level of school systems.

A school level incident developed from a business marketing technique and was a difficult matter for a principal in an elementary school. This principal contended that a big lesson was learned when she allowed a business to use the school to market a product:

Oh, and something else, businesses are getting into the act of marketing through the schools. One big lesson I learned when I came here was, we sent home a water survey form to the parents and all it said was, it was some kind of little questionnaire, five questions, and for every parent who sent one these back, we got one dollar for it. And then if they came back and sold a water filter or had their water tested or something, we got two dollars.

It seemed very harmless. It had been approved by central office. Several schools had done it and made

\$400 or \$500 or something. It really seemed harmless. It turned out to be a major. I learned very quickly that parents resent marketing strategies using their children.

Those kinds of things vary from place to place. One school you'll go to and someone will say, I can't believe the school down the road they made \$400 just by marking five answers on a survey form. And that survey person came to you and you said no. That you weren't even willing to send those papers home and let us mark it. And then the school gets \$500 to buy new computer equipment and then the next place you go, it's a totally different way of looking at it. We resent our children being a part of marketing. The purpose of school is to educate our children. I pay taxes, therefore, that money should be used to support our school. And I resent picking up nickels and dimes through all of these other kinds of things. So, that's just one I can think of.

In summary, 77% of butterfly effect incidents related by principals originated at the school level of school systems. The significance of understanding the surrounding community when making school level decisions was related by a principal, "Part of that kind of thing comes from knowing your community and knowing where they stand on issues." Another principal declared, "You know what the people in

your community will take and what they won't, and you got to have that knowledge."

Research Question 4

Research question 4 focused on the school level of school systems and was stated: Is the butterfly effect precipitated at the school or classroom level of school systems?

It was noted that according to the data, few butterfly effect incidents began at the classroom level. Less than 10%, 7 of the 77 school level incidents originated in the classroom.

However, one principal outlined what he surmised were reasons for the increase in incidents starting at the classroom level. He noted that these situations are becoming more frequent and cited a lack of trust by parents in "us" as the reason:

As far as other situations, a lot of times, I run into things where teachers do something and don't mean it. They may say something to a kid. Kid goes home and says teacher called me a liar. They didn't. They may have implied that they didn't know if they could believe them or not. I have noticed over time I'm having to fight that battle more and more. Parents don't trust us in doing what we are doing. We have to

justify why we are doing certain things. I'm seeing more and more of that.

Teachers interact with students on daily basis in classrooms. Several principals expressed their concern regarding student placement in classrooms and the enormous responsibility that entails. One situation which originated in the classroom concerned a teacher's lack of regard for student rights and the consequences of her actions:

What you've done is you have shown my kid's grades to someone else, and they [parents] don't like that. For demonstration purposes, basically showing students the errors they have made, they don't like you to use his or her kid's paper. Then you're going to cover up the name and that's only fair. We've had those kind of situations. No, no major, well it could be major when you talk about one incident, two, or three because one parent can create a whole lot of chaos for you. That can happen.

And of course as a result the next year this teacher was moved to another school. I thought that the teacher had her own way and nobody could basically tell her anything. She felt that she had been teaching x number of years and her way was the way.

One incident precipitated at the classroom level involved a teacher and her classroom. The next incident presented was an unusual situation and a middle school

principal's continuing attempts to resolve it and the ongoing consequences. The incident started with a complaint by the teacher. The incident was described by the principal:

A teacher has what she describes as an odor in her classroom that makes her sick, nauseated and has caused her to have to be on an inhaler for asthma. She says she has never had asthma before. This lady is an art teacher and so there are all kinds of unusual smells in an art room. They vary from chemicals and crayons and chalk and paint and so forth that one might already find there. She's not new. She's been here for a while but all of a sudden she has taken this on as a cause. Now her students are beginning to complain and I'm getting complaints from parents about the odor in this room. I even, I've been expecting a call from the local TV station who called earlier today to say that they had called earlier to find out about this odor, that they had had a complaint.

And I had talked with her yesterday about trying to keep it from becoming a major issue. That I certainly appreciated the fact that she was having a problem with it, but that I didn't want the students all to become incensed with this problem when the teacher next door to her whose room opens into her room has not complained. Literally hundreds of children

have not complained, only she and a couple of students and I didn't want those two students to become four and four to become eight. And all of a sudden to have this major issue over something that the health department could not find, the safety department has not been able to find and the county maintenance has not been able to find. Nobody can smell it.

The classroom level precipitated less than 10% of the school level incidents. Situations which began in the classroom included teacher interaction with students, student discipline, and a teacher's reaction to a room.

Research Question 5

Research question 5 was stated: Can similar behaviors or patterns of behavior result in the butterfly effect in school systems?

From an analysis of all incident data, 73 incidents were the result of decisions and 24 incidents were attributed to behaviors. Total incidents do not equal 100 because it could not be determined whether some of them were the result of a decision or a behavior.

Teacher behaviors precipitating the butterfly effect exhibited no pattern. Most were in the personnel factor and included a teacher who claimed that her car had been keyed, one who complained of a foul odor in the classroom, and one who failed to report for hall duty. Some incidents involved

teacher behavior directed toward students, including alleged improper behavior with students. One situation that involved touching children became a major issue in one school. One elementary principal related an incident with a classroom teacher and a child:

The idea of being very careful how you touch a child, that can blow out of proportion immediately. We had an incidence where we had a teacher in the fifth grade, a very caring, a very concerned teacher, but they were having a rehearsal for a program. This particular child kept turning around constantly bothering the person behind them. So the teacher went over and took her by the shoulders and just simply turned her to the front to where the director was standing.

That parent was extremely upset. It mattered not whether it was a gentle turn or hard turn, had nothing to do with it. It was the fact that she actually touched her. In that instance we brought the parent in with the teacher. I of course or Mr. Assistant Principal always sit in on those. The teacher explained what had happened, she apologized. And then we also offered the parent, which we always do, a parent complaint form and said, "If you would like to fill this out, then I sign it as the principal and I send it out into the central [office] and then that does go in the record here at central." It could have

been much worse. It just depends. You have to be very, very careful.

One behavior pattern noted was that principals' failure to perform certain activities created butterfly effects. Examples included a principal's failure to carefully read and review a faculty advisory council document which -resulted in the violation of student rights. In another situation the principal failed to notify a central office supervisor when disciplining a special education student. Another example was a principal who failed to send a letter informing parents of lice present at school. He recalled the effects:

We do have a policy manual in each school. And of course we try to adhere and follow closely to the policy. But, in the policy [manual], and this happens to deal with lice, the policy states that if we find a case of lice in a classroom that we are to send home a letter to all of the parents of the children in that classroom, not the school. And of course I had looked in the policy manual, and there was no form letter. It didn't speak to that I was to develop a letter or a letter should be in place. But, there was no letter.

So I had five of the parents of 450 students that we have, to come to the school with the newspaper and the television. And I think we have somewhat made history because of my inability to send that form

letter home. I don't think it was the lice case that they pretended it to be. I think it was more that they were looking for someone to blame. And of course I took the blame, I took the responsibility for this. And we had 3 or 4 days of good television viewing as well as newspaper articles. Some of the parents, many of the parents in the school, did not like the pressures that those few parents and the newspaper and the media was putting on us so they have written to the editorial and stated how unfairly they felt this was.

To reiterate, teacher behaviors that produced large effects demonstrated no similarity. Student behaviors which precipitated butterfly effects were similar because they concerned discipline issues. Parent behaviors exhibited no similarities or patterns. Principal behaviors that spawned disproportional effects were similar because they involved the failure to administer some responsibilities.

Research Question 6

Research question 6 was stated: Can certain decisions or categories of decisions be identified which precipitate the butterfly effect in school systems?

One category of decisions made by the principals which precipitated the butterfly effect in schools and school systems involved change. Changes in curriculum, changes in discipline plans, changes in teaching methods, changes in

parking spaces or cafeteria table configuration, changes in school personnel, and changes to comply with regulations precipitated the butterfly effect in schools and school systems. An incident which illustrated the effects of change on a faculty was narrated by a principal:

So then I go in there and I think females and males often times approach jobs in different ways and I knew that I am not going to touch curriculum, teaching and anything like that in the way of changes the first year. And had met with the teacher committee in August to have them brief me on the school, etcetera. And they told me there wasn't enough space on the parking lots for spaces. And so there was some unmarked space and I sent a work order to ask that spaces be added, the lines numbered. And so I was just going to assign 1, 2, 3, 4, alphabetically to everybody. All of a sudden that was just poof! This big deal!

I said no problem. Park where you usually have been parking for 100 years and tell me what the number is and then those that are left open, we will assign them to the new people and the traveling people and all this. I thought that was symbolic stuff. Little things, I mean, what to me was inconsequential, nothing, was a biggie in some people's mind.

Principals are faced with discipline decisions everyday. Some of those decisions exhibited butterfly

effects for participants in this study. A principal's decision not to expel students for bringing a gun on campus but to suspend them created a major situation. The principal chronicled the events:

We had a situation where a student had a gun on campus and this happened several weeks ago. Two students had a gun. A third student was involved. It was his parents' gun. The boy took the gun from his parents and the boys played with the gun on the weekend. It was a 25 caliber handgun. So they had the gun for a course of 2 to 3 days and one decided that it was his turn to have the gun so he asked the other to bring the gun to school and give it to me so that I can take it home and I can have it. We learned 3 weeks later that this event occurred.

No one ever saw the gun on campus, except the two boys involved. But through 3 weeks of trying to keep high school kids silent, these were 9th graders, they evidently bragged about it or said something about it. Then all of a sudden there is word, we get a call from an assistant principal at the middle school and his statement was, "Did you know that you had a handgun on your campus 3 weeks ago?" We didn't. "Well call these two guys in and they will tell you." So we call these two guys in and they said, "Well, yes, we brought a handgun on campus, and we exchanged the gun and took it

home. The gun was not loaded, did not have a magazine, it was just a swap." Where did you do this? "We did this in shop class." Are you crazy? Do you not know the new policy is, a federal law that it is a major felony now to have, to have guns on campus? "No, we didn't. We just exchanged the gun." Where is the gun now? "We don't know where the gun is now." So through the course of the investigation, parents were called in. Yes indeed the gun is missing. No, the parent does not know where the gun is.

Doe County Sheriff's Department is called in. The boys are taken down town. There is, now we file a formal complaint against the kids. Where I'm getting to is the decision I had to make. Was, do we expel these kids forever from the system? They are 14 years old. Or do you long term suspend? The most I can legally do without having the superintendent's approval, 10 days out of school, take the kids through the court system where a judge, not jury, will try their case and find them guilty or innocent and then allow them to return to school. That was the course I took.

There was no, any evidence of a gun. No one has ever seen a gun, just hearsay and the boys' honesty in admitting that they had a gun. What has happened from that is that the newspaper got a hold of the fact that

Joe Jones, principal at Smith School, was too lenient on students who had possession of a firearm on campus. That the boys should have been expelled from school, never to be allowed back in any school in this state or wherever.

And my position was, is that you just can't throw kids away. They never had, there was no malice or intent to harm. Theirs was a stupid, you know judgement made, decision made by these young men to bring this on campus. Our community being a rural community is such that handguns do not mean the same as in the inner cities. I felt like that a principal should have the discretion to review each case as it happens and act in the best interest of the child.

Well, the superintendent supported me with it. No, problem there. The board members supported me with it. The community supported me on that decision. But it received a lot of press from the community.

Teachers' decisions precipitated the butterfly effect when making choices. For example, the decision to send home Christmas trees with third graders and the choice of a Halloween musical for a second grade production generated unanticipated and considerable effects involving religious freedom in school systems. A teacher's choice to quote Karl Marx in the yearbook also had enormous ramifications including international press coverage.

One category of teacher decisions produced butterfly effects in schools or school systems. That category comprised those decisions regarding the selection of students for membership in honor societies, chorus membership, and drama club. One middle school principal reflected:

The same kind of thing comes with any, happens with any selective process. Tryouts for the drama club, I remember a child, little girl whose mother thought that she was really talented in drama and she was not selected for the drama club. She just went into all kinds of rages and so forth. The same thing happens in our chorus. But every year when we have tryouts for chorus we have some child who goes home in hysterics because they didn't make it. There's always some angry father, disappointed parent and the parent tells me we have just ruined their child's life over some kind of tryout process.

Another middle school principal characterized the selection of students for national junior honor society as more trouble than it's worth. She discussed the effects that ensued from the selection of students and consequently the rejection of other students:

I would probably talk about first of all something at the school level, like something that appears to be a very small and insignificant way of doing something

that has developed into a major situation at this middle school. And that would involve the selection of student council members, national junior honor society members. [She described the selection process in detail.] Invariably every year at selection we have at least one irate parent and as many as three or four who are very concerned because their child was not rated high enough in character or citizenship to get into the National Junior Honor Society. And we have been accused of everything from using the black ball system to just plain old this is not fair. How dare they do that? I've even said on previous occasions that it has almost gotten to the point where I'd just as soon not have an honor society because it's a pain. It's more trouble than it's worth, because parents and kids get in such a twitch over it.

Decisions which precipitated the butterfly effect were divided into those generated by individuals and those generated by consensus decisions. Whether or not decisions were made by consensus or by individuals did not seem to affect the precipitation of the butterfly effect in schools and school systems. Twenty-seven were decisions made by principals and seven were decisions made by teachers. Decisions made by consensus precipitated 35 butterfly effect incidents in schools and school systems. Decisions made by

consensus did not reduce the propensity to produce the butterfly effect.

One principal recounted his attempt to involve everyone in a consensus decision but the effects grew all out of proportion. He was still being teased about it 5 years later:

It [the decision] was widely known. The PTO advertised it and we talked to all the key people. We talked to the room parents about it. Talked to central office so they would know what we were doing so it would not be a surprise to them. It was one of those things where we thought we had taken care of all the bases and yet it still, there was opportunity for something to go wrong and Murphy, although he is not registered on our faculty, probably was part of our faculty that did allow that to happen.

Consensus decisions which precipitated the butterfly effect in schools and school systems generally involved policy matters. School policies governing grading scales, scheduling, textbooks, site-based management, corporal punishment, duty free lunch for teachers, high school graduation requirements, transportation policy changes, and length of school day for kindergartners were example cited by principals. Other consensus decisions were those made by M-Teams for special students.

The only category of decisions discerned was that consensus decisions in all but 5 of 35 incidents had a direct impact on the students.

Ripple Effects

Ripple effects of incidents were analyzed with the critical incident technique previously described (Flanagan, 1954). Ripple effects were spreading, pervasive, and usually unintentional influences that resulted from the incidents. Various categories of ripple effects were derived from the data. These categories included initial ripple effects, communication ripple effects, emotional ripple effects, mediation ripple effects, news media ripple effects, coercive ripple effects, and outcome ripple effects. The ripple effects did not occur in the same sequence and all effects did not occur for all incidents. Some ripple effects continued or were interwoven throughout the incident and the categories sometimes overlapped. Some ripple effects were contained within a school or school system. Others extended into the external environment including the community and society. Insight into these reverberations from an incident may enable administrators to better anticipate and deal with these incidents in schools and school systems or perhaps instigate and promote them.

Initial ripple effects usually occurred soon after the incident. These initial effects included decisions made

relative to the incident and input solicited from colleagues and superiors. Oversights were sometimes made in policy or regulations. For example, one principal related, "We did all those things and thought we had covered the territory completely even including the new nuances to the policy." Initial ripple effects also encompassed documentation and investigation of incidents. Another principal revealed, "I still have all that information in a file if it should ever come back to haunt me." Rumors were another initial ripple effect but were sometimes reported prior and suggesting that principals should anticipate an incident. One principal ruminated,

So that's something right now that is on the fringes that you hear little rumbles and ruffles here or there, ripples here or there with it. And I think it will be on the horizon, some things that we will have to deal with.

The second category, communication ripple effects, came from two perspectives, principal communications and other communications. Principal communication effects consisted of notification of the incident to school authorities, parents, outside agencies, and school personnel. Sometimes principal communications meant staying in close contact with the superintendent, outside agencies, or central office staff. In some cases principals made recommendations, suspended students, or called authorities depending upon the

incident. Other communications included contacts made by parents, teachers, or others to the superintendent, central office supervisors, or school board members. Sometimes many calls were made to influential people. An administrator lamented, "I don't know who all else she called but the health department, you know, the superintendent's office." Calls were also made to the department of human services and the Office of Civil Rights. Many times misinformation was communicated. ... Communities were described as "lining up and choosing sides." A principal recounted a ripple effect from the communication category. He stated, "at last week's PTA board meeting, she brought it up again and there were two other parents there and they just got on the bandwagon and they just rolled with it." One teacher reportedly "whipped the faculty into a frenzy."

A third category of ripple effects was the emotional category. These ripple effects stemmed from a sense of not having been treated fairly, not having input on a decision, having rights violated, or having been offended, berated, or belittled. Emotional ripple effects reported included feelings of irateness, anger, disappointment, and embarrassment. Principals described ill feelings, hysteria, and rages. The school was blamed for the incident in some cases. One parent demanded, "Do you have something against her (student)?" As a result of the emotional ripple effect communities became upset and people removed students from

school or from classrooms. One principal characterized his staff saying, "They hit the royal ceiling." Principals described this type of ripple effect with the phrases "nightmare," "parents went wild," "big to-do," "major flap," and "potential for a real big ugly thing." Parents were portrayed as "angry father, "disappointed parent" and "extremely upset." Teacher emotions were depicted as "weren't happy about it," "feeling put upon," and "bent all out of shape." Principals' interpersonal skills were needed to deal productively with the emotional category of ripple effects. Though productive ripple effects in this category were limited, one principal related that "enthusiasm was high."

Additionally, ripple effects in the mediation category were those that occurred during efforts to reconcile incidents. Principals recounted spending hours with parents and teachers. A principal recounted, "I have spent multiple, multiple hours on this with her." Other mediating ripple effects consisted of meetings held with parents, teachers, and community groups; memos to apprise or correct information; and apologies for events. Guidance counselors were called upon for counseling and conflict resolution was taught. Decisions were reconsidered during the mediation category. Principals recalled "trying to mend fences, pulling back together as a team."

The news media category was another ripple effects category gleaned from the data. This category presented principals with some very interesting public relations situations when dealing with butterfly effect incidents. Television cameras and newspaper reporters placed incidents in the public eye. A principal remembered, "The press was here, the TV cameras." The trail to a controversial or sensational topic attracted the news media. Coverage was sometimes sensational and misinformed. "Somehow the press got hold of that and that was blown quite out of proportion," remarked a principal. Sometimes stories were unverified. Misinformation was amended in some instances but not corrected in others. In one incident, 3 to 4 days of newspaper and television coverage was given to a lice problem and "it turned out to be the top news for Doeville this week." Even after the initial press scrutiny, letters to the editor perpetuated the media coverage. Principals expressed concern about this category of ripple effects. One said, "It had been splashed across the page of the paper and was very negative publicity for our school." New media ripple effects of incidents that improved schools were not reported by principals.

Next, the coercive category of ripple effects included threats, harassments, accusations, and protests made by participants in butterfly effect incidents. "We've got huge demonstrations, we've got student walkouts." A threat to

hire a lawyer was sometimes carried out. Parents harassed school personnel and threatened to get them fired. "In the meantime, they got more threatening." They made accusations that students were blackballed, threatened lawsuits, and complained to central office staff, superintendents, and board members. Teachers took their concerns to superintendents and central office personnel. Group protests, public protests, and sit-down strikes occurred. Phrases like "exploded into an ugly confrontation," "bone of contention," and "explosive issue" were used by principals to describe confrontations.

Finally, outcome category ripple effects were those that resulted as incidents were resolved. Some incidents did not have a conclusion but were ongoing for principals. One recalled, "This may be another solution but the first one was supposed to be the final solution." Outcome ripple effects included school improvements, utilization of new models of discipline, and development of improved faculty and staff relationships. Some teachers resigned from their positions or were given professional development plans as outcome effects. Additionally, some students were suspended, were sent home unexcused, or were transferred to other schools. In the outcome ripple effect category some people accepted objectionable decisions. Student advisory councils were formed. Also, programs and decisions were questioned, reevaluated, and sometimes modified. Dinners

for parents were held to introduce and demonstrate student computer learning. One inner city school raised \$14,000 for a community playground. A reading partnership was developed with a community church, hospital, and business. Outcome ripple effects were still being felt in one case 5 years later.

The following is an example of ripple effects which were contained within the school or school system. The incident occurred when a principal conducted a faculty meeting to address what he considered sabotage of the school program. The following ripple effects were related by the principal.

1. Teachers were offended.
2. Teachers felt berated and belittled.
3. Teachers said the principal had used unprofessional voice tones.
4. Teachers went to the superintendent to complain.
5. Assistant superintendent visited the principal to discuss the situation and how to mend it.
6. Principal made a public apology in a faculty meeting. He stated that if the faculty did not believe in a program they could lay it out on the table and everyone was welcome to do that.
7. Better relationship developed between the faculty and the administration in the school.

Other ripple effects were not contained within the school or school system environment. The following incident illustrated external ripple effects. The incident ensued when after 6 weeks of school a principal requested that a parent discontinue escorting her kindergarten child to class. The principal recounted these ripple effects.

1. Father called and said that his wife would walk their child to class.
2. Wife called the school board and alleged that she had cancer.
3. School board members called the principal.
4. Parents became more threatening to school personnel.
5. Two kindergarten teachers and the school secretary experienced physical symptoms of stress.
6. Principal told mother she could stop at the corner and watch her child walk to the classroom.
7. Principal called central office for backup the following morning.
8. Backup came from central office and mother allowed principal to escort the child to class.
9. Principal was told to appear before the school board.
10. Mother read 45 minutes of complaints to the school board.

11. Principal read documentation of what had actually transpired.

12. Parents hired a lawyer and met with central office staff.

13. Parents were given the option of transferring the child to another school and they did.

An incident that is not contained within the school or school system was often exacerbated if not created by the news media. The following incident was not contained within the school or school system environment. The incident was precipitated when a yearbook sponsor used a quote from Karl Marx in the yearbook. These ripple effects were depicted by the principal.

1. The quote was disseminated to and picked up by worldwide news agencies.
2. A really big "to-do" was made.
3. Principal got into a struggle over censorship.
4. Principal backed the teacher (sponsor).
5. Folks were waving flags and saying it should not be.
6. The story was carried in major newspapers.
7. Parents became enraged over it.

Seven categories of ripple effects evolved from critical incident analysis. Those categories included initial ripple effects, communication ripple effects, emotional ripple effects, mediation ripple effects, news

media ripple effects, coercive ripple effects, and outcome ripple effects. Ripple effects extended to the school environment, the school system environment, and the environment external to the school system. Information about these ripple effects could prove useful to principals who contend with the butterfly effect in schools and school systems. Manipulating the ripple effects might prove valuable.

Summary

Research questions were addressed and observations were made from the interview data provided by principals. These were supported by situations and portrayals related by principals. First, the characteristic of chaos theory known as sensitive dependence on initial conditions or the butterfly effect was recognized in schools and school systems.

Second, six factors of schools and school systems which exhibited sensitivity to initial conditions were identified. The factors were curriculum, discipline, extracurricular activities, personnel, school community, and transportation/facilities.

Third, the level of school systems which precipitated incidents was addressed. Most incidents began at the school level of school systems. Seventy-seven percent were reported as originating at the school level. Nineteen

percent were precipitated at the district level and only 4% began at the state or national level of school systems. Classrooms were identified as producing only 7% of all incidents reported.

The determination of whether or not incidents were the result of decisions or behaviors was addressed. Seventy-three incidents were the result of decisions while 24 incidents were caused by behaviors. The only behavior pattern noted was when principal behavior was a failure to perform some activity.

One category of decisions made by principals was noted as producing disproportional effect. Those were decisions involving change. Also, a category of decisions made by teachers which precipitated the butterfly effect in schools was observed. This category concerned decisions made during student selection processes. The number of decisions made by individuals was compared to the number of decisions made by consensus. Incidents reported in this study were precipitated by individual decisions and consensus decisions about equally, 35 decisions were made by consensus while 34 decisions were made by individuals.

Additionally ripple effects of butterfly incidents were analyzed. Seven categories of ripple effects were derived from the data. These categories were initial ripple effects, communication ripple effects, emotional ripple effects, mediation ripple effects, news media ripple

effects, coercive ripple effects, and outcome ripple effects.

CHAPTER 5

Summary, Observations, Conclusions, and Recommendations

Chapter 5 contains a summary of the study, discusses observations from the research questions, relates conclusions, and provides recommendations.

Summary

This study was conducted to investigate the characteristic of chaos theory called sensitive dependence on initial conditions or butterfly effect in schools and school systems. It was intended to develop insight into organizations of schools and school systems by investigating critical incidents that were sensitive to initial conditions and were therefore likely to produce exponential effects.

Chaos theory has proven useful in understanding organizations and how they function. Schools and school organizations are complex systems composed of numerous interrelated webs of people, organizational structures, facilities, beliefs, and objectives. Chaos theory addresses the workings of complex systems. The Newtonian cause-effect linear worldview can be a theoretical limitation for the administration of complex schools and school systems. By investigating the butterfly effect characteristic of chaos theory as it affected schools and school systems, the

researcher intended to offer another paradigm for consideration by educators.

A modified critical incident technique (Flanagan, 1954) was used to gather data for this study. The critical incident technique provided a means of acquiring primary data from qualified participants rather than limiting responses to selected questions. The critical incidents solicited for this study were those incidents in school systems which exhibited the characteristic of sensitive dependence on initial conditions. These critical incidents were ones in school systems in which the behaviors or decisions seemed insignificant when they occurred but produced relatively large consequences. The long interview method (McCracken, 1988) was used to collect data for the critical incident technique because it attempts to get into the mind of the participant and see the world from his or her perspective. The long interview method facilitated gaining knowledge and experience from principals without a lengthy intrusion into their lives. The amount of time which professionals can commit to an interview, was a consideration for the researcher and the participants.

A limiting factor for this study included the lack of research on chaos theory in education. The nature of the long interview further limited the population size and the geographic area feasible. Another limitation of the study was that observations were not generalizable to other populations.

Access and permission to conduct the study were obtained from school systems and principals. Purposive sampling to maximize diversity was used to select twenty-seven principals from school systems located in the Knoxville area in Tennessee, the Asheville area in North Carolina, and the Roanoke area in Virginia. Principals were interviewed and data were collected for this study. Principals were chosen as participants because they worked in a central position in school systems which enabled them to witness the effects of decisions and behaviors among all levels of operation. Experienced principals were interviewed because time was required for some butterfly effects to develop.

Data from the transcripts of interviews were then analyzed and research questions were investigated. A modified critical incident analysis was conducted on the raw data from the interviews. Factors were derived from data. Factors of schools and school systems which exhibited sensitivity to initial conditions were personnel, curriculum, discipline, school community, extracurricular activities, and transportation/facilities. Levels of origination of incidents were also explored. Seventy-seven percent of butterfly effect incidents were precipitated at the school level of school systems. Incidents were further examined and it was determined that more were generated by decisions than behaviors.

Seven categories of ripple effects of butterfly incidents were derived from further data analysis. These categories included initial ripple effects, communication ripple effects, emotional ripple effects, mediation ripple effects, news media ripple effects, coercive ripple effects, and outcome ripple effects.

Observations

Research Questions

The data were analyzed according to a modified critical incident technique. Incidents were summarized and described to increase usefulness of the data without sacrificing comprehensiveness, specificity, and validity (Flanagan, 1954).

Research Question 1. Can the sensitive dependence on initial conditions or the butterfly effect be identified in schools and school systems?

Principals from the three states recognized and described the characteristic of chaos theory called sensitive dependence on initial conditions or the butterfly effect in school systems. One principal used the metaphor of a skin cancer, in which the melanoma appears the size of a pinhead and if not taken care of results in death, to describe the butterfly effect in school systems. Other

principals related exponential effects from insignificant incidents which resulted in major school improvements. Twenty-seven principals who participated in the interviews described 100 incidents of sensitive dependence on initial conditions from their experiences in schools and school systems.

Research Question 2. Are there factors or categories of critical incidents which can be discerned in school systems?

The six factors which developed from the butterfly effect incident data included curriculum, discipline, extracurricular activities, personnel, school community, and transportation/facilities. Curriculum incidents involved issues of censorship, curriculum content, grading scales, length of the school day, scheduling, site-based management, teaching methods, and textbook selection. Twenty-five incidents were reported in the curriculum factor. Discipline incidents made up 12 of the total and discipline areas involved student behavior, teacher management of student behavior, parental involvement in discipline, and principal administration of discipline. Eleven extracurricular incidents were detailed by principals and issues included band programs, athletics, cheerleading, clubs, chorus, yearbooks, booster clubs, school colors and mascots, and honor societies. Twenty percent of incidents

related were from the personnel factor. Personnel incidents involved personnel dismissal, personnel employment, principal-faculty relations, reassignment of personnel, staff behavior, teacher behavior toward students, and teacher complaints. The school community factor contained 9 incidents recounted by principals. School community incidents encompassed fund raising, business surveys, community projects, playgrounds, and health issues. Transportation/facilities incidents totaled 11 and involved cafeteria seating, traffic patterns, bus transportation, open-spaced buildings, and placement of equipment.

Research Question 3. Is the butterfly effect aspect of chaos theory precipitated at the school, district, state, or national level of school systems?

State and national levels of schools system precipitated only 4 of 100 incidents recounted by principals. District level incidents totaled 19% of total and addressed such issues as school system consolidation, site-based management, textbook adoption, curriculum alignment, facilities, transportation, staff desegregation, personnel, transfer, and the length of the school day. Seventy-seven of the incidents reported by principals in this study began at the school building level of school systems. School level issues included curriculum content, scheduling, grading, teaching methods, censorship, student

behavior, parent behavior, employment or dismissal of personnel, teacher conduct, health issues, concession stand revenues, band programs, student rights, inclusion, traffic patterns, and facilities.

Research Question 4. Is the butterfly effect precipitated at the school or classroom level of school systems?

Butterfly effect incidents did not tend to originate from the classroom. Only seven of the 77 school level incidents related by principals began in the classroom. These incidents which originated in the classroom implicated teachers' conduct toward children, teacher complaints about facilities, and classroom management.

Research Question 5. Can similar behaviors or patterns of behavior result in the butterfly effect in school systems?

Only 23 of the incidents were the result of a behavior. Most incidents were precipitated by decisions. Behaviors which precipitated the butterfly effect in schools were performed by students, parents, staff, teachers, and principals. No similarity in behaviors or patterns could be determined for parents, teachers, or staff. Student behaviors were similar because they were discipline issues. One similarity noted in the behavior of principals was the

precipitation of the butterfly effect due to failure to engage in some behavior. For example, one principal's failure to send a letter home warning parents that lice had been found in a classroom created major repercussions.

Research Question 6. Can similar decisions or patterns of decisions be identified which precipitate the butterfly effect in school systems?

More incidents resulted from decisions than behaviors. Seventy-one incidents were reported that were the result of decisions. One category of decisions made by principals was identified. The category was change--changes principals decided to make in curriculum, teaching methods, parking spaces, cafeteria seating, personnel, and discipline plans. A category of decisions made by teachers was selection. Selection of curricular material and selection of students for inclusion in clubs and societies precipitated the butterfly effect in schools.

Decisions were also analyzed according to how they were made, by individual choice or consensus of a group. Individual and consensus decisions precipitated about the same number of incidents, 35 by consensus and 34 by individuals.

Conclusions

Schools and schools systems exhibit the nonlinear nature of complex systems. The characteristic of chaos theory known as sensitive dependence on initial conditions or the butterfly effect was apparent in schools and school systems. Seemingly insignificant decisions or behaviors can produce large effects in educational systems.

Furthermore, principals' decision making is influenced by their experience with the butterfly effect, the potential of relatively small decisions to generate major consequences. Principals do not expect the linear cause-effect relationship to hold true for all decisions made in complex schools and school systems. Even principals who attempted to consider all eventualities and inform all factions still experienced the butterfly effect. All variables in complex systems cannot be known and some outcomes defy prediction.

Additionally, incidents produce ripple effects that may extend to the external environment of schools and school systems. Principals need skills that enable them to enhance the ripple effect for positive situations and mitigate the effects of negative ones.

Most of the incidents related by principals precipitated negative reverberations on schools and school systems. However some incidents yielded both positive effects and negative effects. The propensity of the news

media to sensationalize negative incidents and consequently contribute to predicaments of principals may have made them more notable. Positive effect incidents occurred but did tend to be reported by the news media.

Butterfly effect incidents were precipitated from many aspects of school system operation. School curriculum and school personnel issues produced nearly half of butterfly effect incidents reported in this study. Issues of change in these two areas propagated disproportional consequences for principals.

Principals who are flexible and adaptable may be better able to anticipate and manipulate the ripple effects of incidents. Knowledge about the community and community expectations should assist principals when faced with decisions that might produce exponential effects. Also, cognizance of the butterfly effect and its potential impact on schools and school systems should benefit administrators.

Butterfly effect incidents tended to originate at the school level of school systems. The fact that principals' perspectives were utilized may have influenced this data.

Behaviors were less likely to generate incidents than decisions. Decisions made by principals which required change tended to result in disproportional effects.

Decisions made by consensus produced about the same number of incidents as decisions made by individuals. How this speaks to site-based management is an engaging notion.

Recommendations

A recommendation is made that studies be conducted which concentrate on butterfly effect incidents which precipitate positive effects in school systems and to identify factors and or decisions and behaviors which have resulted in disproportional improvement for schools and school systems.

It is also recommended that prospective educational administrators be provided with situations or opportunities to consider and utilize alternative paradigms when dealing with complex chaotic systems.

In addition, school system leaders should be prepared for nonlinear disproportional effects in school systems and recognize that effects cannot necessarily be traced to simple causes in complex systems and that simple causes have potential for exponential effects. Also, principal preparation programs should include skills and techniques to productively manage the various ripple effects engendered by butterfly effect incidents.

Incidents that principals anticipated and were able to keep from producing major negative effects or from reaching the external school or school system environment should be investigated. The perception or intuition which identified these incidents early and the methods of controlling the situations should be documented and analyzed.

Also, in view of the tendency for butterfly effect incidents to begin at the school level it is recommended that principals' acquire as much knowledge of the surrounding community as possible.

In addition, teachers' and superintendents' perceptions of butterfly effect incidents should be investigated.

Chaos theory's butterfly effect demonstrates the potential value individuals and seemingly inconsequential choices have to impact education because that one flutter of a butterfly's wings has the potential to have enormous implications for schools and school systems. The seemingly tiny changes may reverberate throughout the entire system and lead to extraordinary changes in overall behavior. Educators need to learn about and nurture positive effect incidents and hopefully to anticipate and avoid the negative ones.

There is much to be learned from experienced principals. It is further recommended that this accumulated professional reservoir of knowledge and experience be tapped face-to-face when conducting educational research. Staff development for educational administrators should include visits to other schools and systems. Time should be scheduled for school leaders to share experiences and learn from each other.

Other aspects of chaos theory should be investigated for potential insight into the operation of complex

organizations like schools and school systems. Features of nonlinear systems such as fractals and their self-similar patterns that repeat on scales but retain their uniqueness may teach us about organizations including educational systems. If fractals could be manipulated in a school system, then desirable self-repeating aspects could produce school improvement. The characteristic of chaotic systems called strange attractors is the part of the system which provides stability and toward which the system moves. Perhaps strange attractors have implications for educational organizations.

It is further recommended that self organizing systems (spontaneous emergence of self-organization) and possible implications for education be examined. For example, the organization of the classroom might benefit from the willingness to think about options provided from within the group itself.

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APPENDICES

APPENDIX A
ACCESS

KNOX COUNTY SCHOOLS
ANDREW JOHNSON BUILDING

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Allen Morgan, Superintendent

January 17, 1995



Ms. Suzan Baker
292 Nofattie Road
Telford, TN 37690

Dear Ms. Baker:

You are granted permission to contact appropriate building-level administrators concerning the conduct of your proposed research study entitled, "Chaos Theory in Educational Systems." In the Knox County Schools final approval of any research study is contingent upon acceptance by the principal(s) at the site(s) where the study will be conducted.

In all research studies names of individuals, groups, or schools may not appear in the text of the study unless specific permission has been granted through this office. The principal researcher is required to furnish this office with one copy of the completed research document.

Good luck with your study. Do not hesitate to contact me if you need further assistance or clarification.

Yours truly,

A handwritten signature in cursive script that reads "Samuel E. Bratton, Jr." with a checkmark to the left.

Samuel E. Bratton, Jr., Coordinator
Research and Evaluation
Telephone: (615) 594-1740

xc: Dr. J. W. Phifer, Coordinator of High Schools
Ms. Shirley C. Underwood, Coordinator of Middle Schools
Ms. LaNoka O. Rhodes, Coordinator of Elementary Schools

Project No. 514

**INFORMATION REQUIRED FOR PERMISSION
TO CONDUCT RESEARCH IN THE KNOX COUNTY SCHOOLS**

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1. Name and mailing address of the researcher(s)
2. Telephone number where the researcher(s) can be reached in the daytime
3. Position(s) of the principal researcher [undergraduate student, graduate student, or college professor (specify institution), Knox County employee (specify job and location), other (specify occupation and affiliated institution, if any)]
4. Exact title of the proposed study
5. Brief description of the proposed study which is not limited to but must include (1) a purpose, (2) a targeted population (who and how many), (3) data collection procedures, (4) an estimated time required by Knox County participants, and (5) projected value of the study to Knox County, if any
6. Single copies of all questionnaires, surveys, tests, answer sheets, structured interviews, or other instruments that will be used by Knox County participants
7. Single copies of cover letters, copies of instructions, parent permission statements (for student participation), etc.
8. Approximate proposed times for beginning and ending the study

* * * * *

Prior to making an appointment for a personal interview, above material should be sent to:

Dr. Samuel E. Bratton, Jr.
Coordinator, Research and Evaluation
Knox County Board of Education
P. O. Box 2188
Knoxville, Tennessee 37901

Room 1420, Andrew Johnson Building
912 South Gay Street



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OFFICE OF DIVISION SUPERINTENDENT
ROANOKE COUNTY SCHOOLS

8837 COVE ROAD N.W. ROANOKE VIRGINIA 24018

March 8, 1995

TO: Secondary Principals

FROM:  James Gallon, Assistant Superintendent

SUBJECT: **Research On Chaos Theory By Suzan Baker**

Suzan Baker, a doctoral student at East Tennessee State University has presented her research theory and wishes to interview certain principals to document Chaos Theory. She has stated that the names of principals, schools, and school divisions will not be identified and used in the research.

As is the case, you may participate if you wish and are satisfied with the process and how the results will be used.

You may drop out or decline to participate in the process. Be sure you are comfortable with the research and the process. Please call me if you have questions.

bc

Enclosure



**Roanoke
City Public Schools**

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Division of Instruction • P.O. Box 13145, Roanoke, Virginia 24031

April 5, 1995

**Suzan Baker
Principal
West View School
2847 Old State Rt. 34
Limestone, TN 37681**

Dear Ms. Baker:

I appreciate your interest in the area of chaos theory, notably the "butterfly effect:" as it operates within school organizations. I am sure that your previous study in this area has motivated you to extend your interviews into other school divisions, however, I must inform you that the various sites within the Roanoke City School division will not be participating in your study. Although you have proposed some interesting questions, I am not convinced that your area of interest would be of sufficient value to our division at this time. Although the chaos model is one which is receiving considerable study in many areas of practice, our principals are focused in other areas of study as reflected in the school board goals and objectives. These areas of study include site-based leadership implementation, a complete curricular and instructional program review, and several other projects designed to support each individual school's biennial plan.

I wish you success in the pursuit of your degree and trust that you will find alternative sites for your study.

Sincerely,

**Vella S. Wright
Director
Research, Testing and Evaluation**

APPENDIX B
LETTER TO PRINCIPALS

Date

Suzan Baker
292 Nofattie Road
Telford, TN 37690

Principal
School
Address
City, State, Zip Code

Dear Principal:

I am a candidate for the doctoral degree in education in the department of Educational Leadership and Policy Analysis at East Tennessee State University. I am also a principal in Washington County, Tennessee, at West View School.

As a principal I am aware of your busy schedule and the demands on your time. At the same time I would like to explore your unique experience and knowledge gained as you perform the very important and critical job as principal.

I am researching a characteristic of organizational theory and would like to learn about the characteristic from a practicing principal. I would greatly appreciate an opportunity to record your experiences in an interview. The topic of discussion will be decisions or behaviors which seemed insignificant when they first occurred but later resulted in large consequences.

The interview will probably take less time than answering a lengthy survey. I will be contacting you to arrange the interview. Your time and expertise will be very much appreciated. Your name and the content of the interview will be kept completely confidential.

Sincerely,

Suzan B. Baker

APPENDIX C
STANDARD ETHICS PROTOCOL

Standard Ethics Protocol

Hi, my name is Suzan Baker. I am a researcher working on a dissertation at East Tennessee State University. You may contact the university at this phone number 615-929-5307.

Thank you for your willingness to participate in this research project. Your participation is very much appreciated. Just before we start the interview, I would like to reassure you that as a voluntary participant in this project you have several very definite rights.

First, your participation in this interview is entirely voluntary. You are free to refuse to answer any question at any time. You are free to withdraw from the interview at any time.

This interview will be kept strictly confidential and will be available only to the researcher and a transcriber, members of the IRB, and the dissertation committee.

Excerpts of this interview may be made part of the final research report, but under no circumstances will your name or identifying characteristics be included in this report.

I would be grateful if you would sign this form to show that I have read you its contents and that you voluntarily agree to participate in this research project.

_____ (signed)

_____ (date)

APPENDIX D
QUESTIONNAIRE

Original Questionnaire

Thank you for assisting in this research. Your time and knowledge are greatly appreciated. As a principal you are in a unique and pivotal position to observe the impact of decisions and behaviors. You witness this impact both on the school and its operation at multiple levels and from the higher levels of authority to the basic level. You are considered an expert. This research is an attempt to identify and analyze a characteristic of chaos theory called the butterfly effect as it operates within school organizations.

Name _____

Age _____

Sex _____

Highest educational level attained _____

Current position _____

School and system _____

Number of years experience at current position _____

Think of your most recent experience in which a seemingly insignificant decision had very large disastrous results.

When did this happen?

Tell me exactly what this decision (behavior) was?

Who made the decision (or exhibited this behavior)?

At what level of school operation did the decision get made (behavior occur)?

What were the circumstances leading up to this decision (or behavior)?

Tell me exactly what the impact was.

How long did it take for the effect of this decision (behavior) to happen?

Why do you think this decision (behavior) had such enormous repercussions?

Can you think of any other similar situations?

Can you think of another recent experience in which a seemingly routine or insignificant behavior had disastrous results way out of proportion?

Repeat above sequence of questions.

Can you recall any other seemingly inconsequential decisions (behaviors) which resulted in disproportionately positive effects?

Repeat above sequence questions.

Interview Modification

The original questionnaire was modified as the study progressed. The fixed set of questions was replaced with a general discussion of the kind of incidents that principals were asked to recall.

Principals were told that they were considered the experts in this study and that the researcher wanted to learn from their experiences in schools and school systems. They were told that principals functioned in a unique position in school systems which allowed them to observe the effects of decisions and behaviors at all levels of school system operation. Principals were asked to draw on their knowledge and experience in schools and school systems and relate sensitive dependence on initial conditions or butterfly effect incidents. The explanation of the type of incident they were to report was that the incident began as a routine, small, or insignificant decision or behavior which over time developed into a much larger issue. The decisions may have been routine when they occurred but became disproportionately major matters over time. Principals were told that these effects could be positive or negative.

APPENDIX E
AUDIT

June 12, 1995

Suzan B. Baker
292 Nofattie Road
Telford, TN 37690

Dr. Carolyn Brown
385 Lori Circle
Chuckey, TN 37641

Dear Dr. Brown:

Thank you for agreeing to audit the research I am conducting for my doctoral dissertation. I hope that the process will prove an interesting and useful experience for you and that it will provide insight into the principalship. The following components are submitted for conducting the audit.

1. According to Guba and Lincoln (1989) the concept of the audit is based on the metaphor of the fiscal audit. The auditor in the research process is interested in the quality and appropriateness of the research process. The auditor also must attest to the fact that the "data" can be traced to original sources and confirmed.

2. Eisner (1991) contended that credibility in qualitative research depended on structural corroboration, consensual validation, and referential adequacy. Structural corroboration, or utilizing multiple types of data was not used by the researcher due to the nature of the study. The auditor will provide consensual validation or "agreement among competent others that the description, interpretation, evaluation, and thematics of an educational situation are right" (p. 112). Referential adequacy is the extent to which the researcher brings meaning to or illuminates the study.

You will be provided with the data analysis, tapes of the interviews, transcripts of the interviews, data analysis documents, notes, and informed consent forms.

Your professionalism and expertise are greatly valued. Thank you for your willingness to help.

Sincerely,

Suzan B. Baker

DATE: JULY 25, 1995

TO: MS. SUSAN B. BAKER, DOCTORAL CANDIDATE
EAST TENNESSEE STATE UNIVERSITY

FROM: DR. CAROLYN H. BROWN, CHAIR DEPT. OF BEHAVIORAL SCIENCE
KING COLLEGE

RE: FINAL AUDIT REPORT

It has certainly been my pleasure to work with you this summer and to conduct the audit trail for your dissertation work. I have been impressed with your perseverance in undertaking research with a qualitative focus.

The external audit procedures have been completed and a detailed outline of the entire process is attached. The processes were carefully followed, documented, and confirmed through several meetings and discussions. The audit process was a continual project beginning in early June and ending in July.

According to specified criteria based on the work on Guba and Lincoln, the audit addressed the dependability, confirmability, and credibility of the tapes, transcripts, and actual data analyses.

In the area of dependability, data from the selected samples were accounted for and all reasonable areas were explored. A few minor transcriptionists and typing errors were noted on the hard copies, but had no affect on data analysis or categorization. Both negative and positive critical incidents, as cited by the principals were recorded, and efforts to not influence the responses was noted on numerous occasions. In giving directions, the researcher made every attempt to not lead the responses.

The confirmability of the findings are grounded in the data. After the initial listening of the tapes for transcription accuracy and dependability, critical incidents were outlined from the sampling of the ten tapes that were audited. In a final meeting on July 21, 1995, the verification of the categories, as well as the incidents themselves, identified by the researcher and the categories identified by the auditor were in congruence. This process further reduced researcher bias in categorization and confirmed that the inferences of critical incidents were logical.

In conclusion, the data gathering process (interviews), transcriptions, categorization, congruence of incidents and categories and identification of rippling effects of principal-made decisions, are dependable, confirmable, and credible.

The results of your study should prove quite beneficial in providing training and simulation exercises for new principals. The work is certainly worthy of presentation at local and state conferences and I would encourage you, not only to pursue this option, but to seek an avenue for publication of your work.

Congratulations on the completion of your dissertation! I feel privileged to have had the opportunity to work with you and wish you continued success in your future endeavors.

External Audit Procedures

Following established auditing procedures for validation of transcription accuracy and use of quoted material by principals who participated in the study, the following steps were implemented.

1. I was selected as the external auditor and provided with criteria for conducting the audit.

2. I, Dr. Carolyn H. Brown, Associate Professor at King College in Bristol, Tennessee and Director of Institutional Assessments, agreed to serve as auditor. I have taught graduate level research at East Tennessee State University in the Department of Educational Leadership, Tusculum College, and King College where she teaches the statistics and research sequences of courses at King College. I also work on a private basis as a data consultant for doctoral students and am well-qualified to conduct the audit.

3. A meeting was arranged between the auditor and the researcher on June 13, 1995. During that meeting, the number of interviews conducted, locations (Virginia, North Carolina, and Tennessee), and other pertinent details were provided. The cassette tapes along with the typed hard copies of the interviews, and a calendar displaying the dates of the interviews, times, and places were left with the auditor.

4. The actual audits of the tapes occurred between June 14 and July 5, 1995. A total of 10 tapes were audited representing slightly more than one third or 37% of the interviews.

5. I conducted a stratified random sample from the total of 27 interviews. Stratification was based on three factors--state location (TN, VA, or NC), dates of interviews (some selected were interviewed in January, others in February, March, and lastly, in April), and also stratified according to school configuration (elementary, middle school, or high school).

I listened to the tapes and simultaneously read the hard copy for verification of accuracy. The following list outlines the schools selected, location, configuration, date of actual interview and date of auditing:

- a. Elementary School, K-5, Knoxville, Tennessee, 02/02/95, 06/14/95.
- b. Elementary School, K-5, Asheville, North Carolina, 01/23/95, 06/16/95.
- c. High School, Asheville, North Carolina, 01/23/95, 06/19-20,95.
- d. Elementary School, K-5, Knoxville, Tennessee, 03/03/95, 06/22/95.
- e. Elementary School, K-5, Knoxville, Tennessee, 3/03/95, 06/22/95.

f. Elementary School, K-5, Roanoke, Virginia,
03/13/95, 07/05/95.

g. Elementary School, K-6, Roanoke, Virginia,
03/13/95, 07/05/95.

h. Elementary School, K-5, Knoxville, Tennessee,
04/10/95, 07/05/95.

i. Middle School, 6-8, Asheville, North Carolina,
04/11/95, 07/06/95.

j. High School, Asheville, North Carolina, 04/11/95,
07/06/95.

6. In a face-to-face meeting between the auditor and the researcher on July 7, 1995, following completion of listening to the tapes, the tapes were returned to the researcher. I made comments in the margins of the transcripts and tentatively outlined critical incidents that fit the criteria. Another meeting was scheduled to confirm the "fit" of the initial categorization of the incidents by the researcher. Did the auditor identify similar incidents and was there congruence in classifications of critical incidents between the auditor and the researcher?

7. In a meeting on July 21, 1995, incidents noted by the auditor were then compared to the classification processes utilized for data analysis by the researcher. A random sample, representing the three geographic areas, of the 10 audited tapes was selected. The incidents outlined by the auditor were compared with the data reduction cards

based on the following criteria: (a) Were the same critical incidents identified by the auditor and the researcher?, (b) Did the auditor and the researcher deduce same or similar categories for the incidents?, and (c) Were the ripple effects of incidents identified by the auditor and the researcher congruent?

The auditor and the researcher identified the same critical incidents in the selected sample cases and there was congruence in classification. There was one discrepancy noted in classification of an incident, not the incident itself.

In summary, with only a few minor differences, I confirmed the validity of the tapes and the accuracy of the hard copy transcriptions. The minor discrepancies had no effect on the final data analysis. The auditing process reflected no major discrepancies between the actual words of the participants, the hard copy transcriptions, and use of quotes from the interviewees in data analysis. Congruence was found between the raw data and incidents, between incidents and categories, and identification of ripple effects.

Dr. Carolyn H. Brown

VITA

SUZAN BUMGARNER BAKER

Personal Data: Place of Birth: Waynesville, North
Carolina
Marital Status: Married

Education: University of North Carolina at
Asheville, 1968-1970.
East Tennessee State University, Johnson
City, Tennessee; B.S., 1980.
East Tennessee State University, Johnson
City, Tennessee; M.A., 1982.
East Tennessee State University, Johnson
City, Tennessee; M.A.T., 1983.
East Tennessee State University, Johnson
City, Tennessee; Ed.D., 1995.

**Professional
Experience:** Graduate Assistant at East Tennessee
State University, 1981-82.
Adjunct Faculty, East Tennessee State
University, Johnson City, Tennessee,
1981.
Teacher, West View School, Washington
County Schools, Jonesborough,
Tennessee, 1982-1993.
Principal, West View School, Washington
County Schools, Jonesborough,
Tennessee. 1993-present.

**Professional
Organizations:** Member of Phi Delta Kappa
Member Upper East Tennessee Principals'
Study Council