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SHIFTING WORLDS:  
LEADING EDUCATIONAL CHANGE IN A QUANTUM UNIVERSE

BY

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DISSERTATION

Submitted to the University of New Hampshire  
in Partial Fulfillment of  
the Requirements for the Degree of

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in

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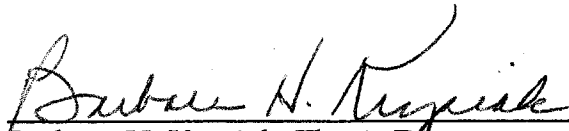
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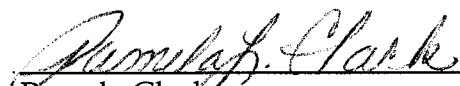
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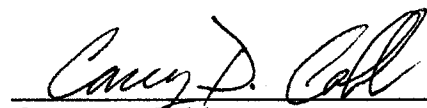
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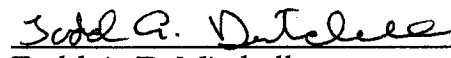
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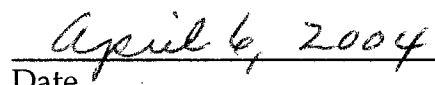
  
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## DEDICATION

**In memory of my great aunt, Isabelle May Orr Pearson.** She served the schools of Winsted, Connecticut for 42 years—28 of them as the first and only principal of the Central School after it opened in 1928 until her retirement. At her testimonial banquet in 1956, the school board announced its unanimous vote to re-name the school: the Isabelle M. Pearson School (Sheldrick, 1971, p. 107).

**To my mother, Jennie Isabelle Orr Douglas,** for modeling love of continuing education and telling me I could be whatever I wanted.

**To my daughter, Jessica Lynn Singer,** for graciously coding and entering my survey data.

**To my son, Douglas Jacob Singer,** for graciously assisting with my computer conundrums.

**To my spouse, Neil Robert Singer,** for managing the practical aspects of our lives while my head was in the clouds; for making me laugh; and for insisting—on occasion—that I watch a television program, sing a set with our quartet, visit a friend, or otherwise engage in discourse with other human beings.

I couldn't have completed these studies without you all.

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In 1994, my committee chair Barbara Krysiak introduced me to Meg Wheatley's *Leadership and the New Science* (1992) and encouraged me to follow my passion. She has guided me through wide parts and narrow in the process of completing my Ph.D.

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ABSTRACT

SHIFTING WORLDS:

LEADING EDUCATIONAL CHANGE IN A QUANTUM UNIVERSE

By

Mary O. Douglas Singer

University of New Hampshire, May 2004

The twentieth century theories of quantum physics and chaos theory in mathematics have had an impact across disciplines, but in many ways educational leaders have been trapped in the old Newtonian paradigm. The conceptual portion of this study bridges the paradigms to suggest new ways to view school leadership for the twenty-first century, using New Science constructs, systems thinking, and leadership concepts of business writers Senge (1990) and Wheatley (1992). It argues that such business models *are* appropriate for school organizations, and builds a conceptual model of a quantum principal who may participate in creating change through transformation (Burns, 1978) and revolution (Alinsky, 1946, 1971).

The empirical portion of the dissertation compares the interaction of change, perceptions of change, and perceptions of the principals' leadership in two New Hampshire high schools over the ten-year period from 1992-2002. One high school changed considerably; the other maintained status quo. Information on principals' leadership styles was gathered by surveying the faculties at the schools one time in 2002,

asking for their retrospective evaluations of their principals based on the model of leadership. Follow-up interviews were conducted with the five principals and with six teachers at each school, A leadership profile for each principal was developed from these data.

The findings suggest that change within a school emerges from the interactions of the situation and the leadership styles of the principals. Four of the five principals interviewed were rated “better than average” in leadership by their faculties, yet good leadership “skills” and intent to change did not always result in changes. More systemic change happened in the more disorganized (chaotic) school. Change continued even under the leadership of the poorly-rated principal.

This research suggests that effective leadership for change fosters risk-taking with an emphasis on creating a feeling of confidence and comfort in the process of change and motion, as well as building connection, communication, and capacity among all parts of the system. Processes, inter-relationships, and diverse people’s interacting energies create solutions. The New Science paradigm provides a powerful way to re-think the role of leadership in connection with change in schools.



## CHAPTER I

### DEFINING THE PARADIGM: INTRODUCTION

**RESEARCH QUESTION:** How do the scientific understandings derived from the New Sciences provide valid understandings of the real world?

It is the coming together of this new philosophy of physics with the respective philosophies of culture of mankind that is the major event in today's and tomorrow's world. —(F.S.C. Northrop, 1958, p. 26).

*In the future: 2023 C.E.* It is June, and Principal Ikara of Anytown High School is reflecting on her progress in leadership, feeling pleased at what she has been able to do. In the three years since she took on leadership of the school, she has worked to create an atmosphere where teachers and students are willing to take risks and to set their own purposes for learning and teaching, within the requirements of the skills-based curriculum. She has developed—with the staff, parents, students, and superintendent—a vision of the school as a cooperative, collaborative, human organization which has the overall objective of advancing student learning. The workshops she has led or sponsored with her teachers have emphasized student motivation and strategies for improving student engagement through an understanding of Perceptual Control Theory (Powers, 1973).

Most of her teachers also understand the school as part of a larger system, and have at least some knowledge of how feedback loops can either slow down or speed up the process of change. And they seem to be, she has noticed, less fearful of change. There's no use fighting change—Ikara knows, and her teachers know it, too—change is part of living in the modern era. The increasingly rapid changes and educational

demands of the 1980's and 1990's had proved Toffler's (1970) *Future Shock* premises correct.

Ikara is proud of the ways in which her teachers have integrated action research plans into their teaching repertoires. Nearly everyone has made assessment of student work a part of the feedback to keep students actively involved in their own learning. The School Board and the Central Office view change differently now, planning for the short term in specific detail and keeping long-term goals broad and flexible. She is most proud of the attitude her teachers and administrators now demonstrate: a view of the world as “holistic, inclusive, and dynamically complex” (Havens, 1997, p. 107), and a view of their primary job as “capacity-building” (Darling-Hammond, 1993, p. 754). The paradigm had shifted: Ikara's school, with her leadership and support, has made the shift.

#### Overview, Research Question, and Definitions

As the 20<sup>th</sup> century drew to a close, the ideas of quantum physics and studies of nonlinear dynamics (popularly referred to as chaos theory)—here referred to in combination as the New Science—had begun to have an impact in many disciplines, most prominently in the popular business works by Margaret Wheatley (1992/1999<sup>\*</sup>) and Peter Senge, et al. (1990,1999, 2000). The implications for educational leadership were still not clear, although Senge et al.'s 2000 publication of *Schools That Learn: A fifth Discipline fieldbook for educators, parents, and everyone who cares about education* offers many specific school examples and applications. The paradigm shift is already in process.

---

<sup>\*</sup>Wheatley published *Leadership and the New Science: Learning about organization from an orderly universe* in 1992; the second edition, *Leadership and the New Science: Discovering Order in a Chaotic World*, was published in 1999. Hereafter 1992 will be the citation date when referencing this work, unless specifically quoting words or concepts that appear only in the second edition.

The purpose of the conceptual portion of this dissertation is to look at this 20<sup>th</sup> century paradigm shift to New Science thinking—with its emphasis on wholeness and interrelationships—and answer this question:

How does the New Science way of looking at the universe affect our 21<sup>st</sup> century conceptualizations of schools, educational research design, and school leadership?

The conceptual part of this dissertation investigates the theories of the New Sciences as they apply to education and educational leadership, contrasts them with the old paradigm, and points the direction for more research to establish a theoretical and philosophical basis for educational leadership in the 21<sup>st</sup> century.

The empirical portion of the dissertation is based on a model of educational leadership developed in Chapter IV, and investigates the leadership in two public high schools over a ten-year period from 1992-2002—using retrospective reflections of teachers at the two schools during that time period to evaluate leadership skills of the principals under whom they worked. Survey data and follow-up interviews with twelve individual teachers—six at each school—help to provide leadership profiles of the five principals who served at the two schools in Edgetown and Middletown (two middle-class communities in New Hampshire), and to evaluate how their leadership styles contributed to the changes taking place or not taking place at their schools.

In this chapter, I introduce the concepts of quantum physics and chaos theory that will be taken up in this dissertation. Table 1, pages 4-7, provides brief, basic definitions and educational examples of the terms. These concepts and their connections to organizational theory will be fleshed out in more detail in Chapter III: *From New Science*

to *Organizations to Schools*. For clarification of concepts used in this chapter and throughout the dissertation, see Table 1.

Table 1:  
New Science Terms, Definitions, and Examples

Term	Definition	Science Example	Leadership/ School Example
<b>attractor</b>	--"any point within an orbit that seems to attract a system" (Hayles, 1990, p. 147); where systems tend to end up, no matter where they start.	The attractor of a pendulum is "the mid-point of its period....Because this point is always the same, the pendulum is said to have a fixed-point attractor" (Hayles, 1990, p. 147).	A stated or established policy serves as an attractor as people within a school focus on the policy and use it to guide decisions (Sullivan, 1999, p. 415).
<b>--strange attractor</b>	--"an odd combination of simplicity and complexity, determinand unpredictability" which results when the iterations of a nonlinear system are graphed over time (Hayles, 1990, p.149); more complex than the single point of a pendulum swing, the strange attractor is fractal.	The Lorenz attractor was named after the meteorologist who first traced iterations of the nonlinear equations he was using to simulate weather patterns in phase space. See illustration in Chapter III, Figure 3.3, p. 76.	Curriculum emphasis shifts back and forth in varying positions from child-centered to subject-centered (Fiene, p. 112).
<b>butterfly effect</b>	--initial small effects which may result in large outcomes; sensitive dependence on initial conditions.	In weather, accurate long-term prediction is impossible because so many small effects can cause massive changes.	Small things can cause huge problems; leaders who understand how quickly changes can cascade through an organization can prepare their people so the organization grows.
<b>chaos</b>	--the deterministic, unpredictable results of nonlinear systems.	The unpredictable fluctuations of a liquid in a state of turbulence indicate chaos. There is no predictability or pattern to the liquid's flow.	Under the Newtonian paradigm, chaos was feared as a period of uncontrolled disorder; New Science leaders welcome perturbation and unrest, recognizing that some "chaos" is necessary for growth.

Table 1 continued

Term	Definition	Science Example	Leadership/ School Example
<b>--the edge of chaos</b>	--the place where systems are at the optimum performance potential.	At the onset of turbulence in a stream of water, the edge of chaos is the point <i>just before</i> the wild fluctuations and chaos break out.	The place in the change process where school people are poised for change and can "ride the wave" to a new way of operating.
<b>classical mechanics</b>	--Newtonian physics, based on the deterministic laws of motion, inertia, and gravity. "One thing follows another in strictly determined order and with entirely predictable result" (Zohar and Marshall, 1994, p. 47).	Movements of simple (and complex) machines can be described well with classical mechanics. A clock-works, set in motion, continues with no new energy input until inertia causes it to slow and stop.	The Newtonian view of school administration was rigidly hierarchical and based on a belief that equilibrium is the desired state of a school (or any) system. The leader sets the direction and guides the school with little input from the students/teachers/parents.
<b>complementarity</b>	--the notion that "pairs of concepts are interrelated and cannot be defined simultaneously in a precise way" (Capra, 1985, p. 160).	Physicist Niels Bohr explains the paradox of subatomic waves and particles: each description of the same atomic reality is only partly correct, and both are needed for a full description; "the precise relationship between the two is given by the uncertainty principal" (Capra, 1985, p. 160).	Opposite concepts form a complete wholeness which must be understood and embraced. This paradox of wholeness leads to a shifting of perspective to see that the perturbations of chaos can lead to order and re-organization; it's all part of the same picture. School leaders must be willing to embrace extremes of opinion and action.
<b>complexity</b>	--the state of a system in which a great many independent parts interact in a great many ways.	Billions of interconnected neurons interact in complex ways within the human brain (Waldrop, 1992, p.11).	All of the resources, needs, wishes, and expectations of the people who are part of a school community (administrators, teachers, parents, students, community members) are related in many ways and in patterns which are intricate and complex (Sullivan, 1999, p. 420). For an illustration, see Appendix B, Figure 3.

Table 1 (continued)

Term	Definition	Science Example	Leadership/ School Example
<b>dissipative system</b>	--a system in which outside resources or energy must be incorporated to keep it going.	A child on a swing must either pump or get a push to keep going.	A school is a dissipative system in an economic sense, requiring inputs of money for teacher salaries and student supplies. The output—student knowledge—is not an immediately salable object.
<b>equilibrium</b>	--a state of stability or balance in a system, with no large-scale change.	In Newtonian physics, the ideal state of a system, balancing inputs and outputs of energy.	Under the old paradigm, equilibrium was a state to strive for, while chaos was to be shunned; in New Science thinking, a school at equilibrium is a school in danger of stagnation.
<b>evolution</b>	--the change, reorganization, or development of a system; the word evolution implies a better adaptation to the existing conditions, an “intelligent and cooperative adjustment to an ever-changing context” (Sullivan, 1999, citing Peat, p. 414).	The word evolution now has meanings beyond Darwin: a system plunges into chaos, and although a specific orbit is not predictable, the <i>evolution</i> of its cycles can nevertheless be observed through time.	Leaders develop a recurrent approach to planning which sets long-range goals in broad strokes, but plans short term in detail, recognizing that each small change may create ripples that will be felt down the road.
<b>field</b>	--the mechanism by which an object exerts action at a distance; the area within which a force is felt or observed.	In describing a force such as magnetism or gravity, the field is the area within which the force of attraction or repulsion is exhibited. In quantum physics, the field is the area over which particles can exhibit connections.	The concept of fields is central to systems thinking. The field in which leaders operate is only a part of the total system; one’s field of influence may extend invisibly beyond the perceived. Likewise, many other fields may impinge upon one’s field of action.
<b>fractal</b>	--the pattern of self-similarity; “detail on every scale” (Meredith, 2003).	In geometry, similarity of pattern across many scales is known as fractal geometry.	In a school, the national standards, state standards, local school standards, and the standards of Ms. McPherson’s second grade classroom are the fractal patterns that can be observed throughout the school.

Table 1 (continued)

Term	Definition	Science Example	Leadership/ School Example
<b>nonlinear dynamics</b>	--another name for chaos theory. Dynamics means changes. In systems which are nonlinear, equal causes do not have equal effects.	Gleick (1987,) gives the example of a playground swing which might be provided a "push" by a machine. The swing decelerates as it swings up, accelerates as it swings down. Its "motion can also turn erratic, first high, then low, never settling down to a steady state and never exactly repeating a pattern of swings that came before" (p. 42).	In a school, a principal should anticipate results of administrative decisions to vary depending on the ways in which such decisions resonate within the context: some decisions will be accepted and embraced; some will encounter huge resistance. An understanding of the culture of the school may help a new administrator to predict reactions and make compensatory plans.
<b>open system/closed system</b>	--an open system has energy coming in, has a process for converting energy into some other form, and has energy going out. A closed system (quite rare) is self-sustaining.	A sealed terrarium is a <i>closed system</i> . Water from the soil and plants evaporates, condenses on the ceiling and then drips down. Still, if a terrarium is placed near a window, it may absorb sunlight and convert that energy, becoming, in effect, an <i>open system</i> that outputs foliage, oxygen, etc.	The open system of a school has inputs from students, parents, teachers, administrators, and other stakeholders; informational inputs also come from society, from educational innovations and directives. See Appendix B, Figure 3. The conversion processes are teaching and learning. Outputs are in the form of information, graduating students with new skills and abilities, and staff turnover (Sullivan, 1999, p. 411).
<b>quantum leap</b>	--an instantaneous transition or connection.	Electrons in atoms jump from one orbit to another in discontinuous "quantum leaps." The size of the leap depends on how many quanta of energy they have gained or lost.	A sudden move from one state or position to another—without a slow process of "phasing in," e.g., a transformation in a change process.

Table 1 (continued)

Term	Definition	Science Example	Leadership/ School Example
<b>quantum mechanics (or quantum physics)</b>	--the new science which describes motion and being of sub-atomic units.	The nature of being (wave-particle dualism) and the transformation of quantum systems when they merge and overlap gives rise to a new reality which is more than the combination of a+b plus the interactions between them.	As Zohar and Marshall (1994) point out, an understanding of quantum holism in a managerial context suggests that "power relations" may not be the best or most effective way to manage people and events. The principal "who tries to 'influence' or 'control' events may be less effective than the one who can be sensitive to the spontaneous emergence of social or political 'trends'" (p. 63).
<b>self-organization</b>	--the ability of parts of a system to develop an order or pattern, seemingly without specific direction from the top of the hierarchy.	"Flying birds adapt to the actions of their neighbors, unconscious-ly organizing themselves into a flock" (Waldrop, 1992, p. 11).	Teachers emerge into leadership roles as the situation demands, often <i>without</i> being asked or ordered to do so by administrators.
<b>systems theory</b>	--the concept of the world and universe as being made up of complex systems, which have identities as wholes and are not reducible to their individual parts.	Hayles (1990) gives an example of how a system functions when it has fixed points: "Imagine a bullwhip moving at just the right frequency so that a small twitch of the handle is transmitted into larger and larger waves all the way down to the end, causing the whip to emit a loud, satisfying CRACK" (p. 156).	While administrators may take actions to "lead" their organizations, their actions may be fruitless if there are not people on board ready to follow through. Likewise, change may begin from unanticipated sources both with-in and outside of the organization.
<b>turbulence</b>	--the unpredictable disruption of a system as it slips into chaos.	Turbulence in the flow of a stream is when it breaks into whirls and eddies which bubble up in unanticipated ways and disrupt the smooth flow.	Leaders must be prepared for occasional dips into turbulence: one has to go beyond shallow waters, sometimes, and brave the hazards of the deep, fast-moving stream; one must negotiate the rapids to achieve mastery.



## Newtonian Worldview Vs. New Science Worldview

The ideas first of quantum physics, and then of chaos theory—in the latter half of the 20<sup>th</sup> century—have developed and gradually shifted scientific thinking, in contrast to the thinking that developed based on the classical physics of Sir Isaac Newton. Newton's theory of gravity and mechanics of forces, laid out in his *Principia* in 1687, created the science of physics and provided the basis for industrial technology as it developed in the eighteenth and nineteenth centuries. But in the time since Max Planck's quantum hypothesis was published in December of 1900 (Heisenberg, 1958, p. 31), the worldview taken by physicists has changed drastically. Quantum physics and chaos theory in mathematics (dating from the 1963 publication of Edward Lorenz's weather experiments) have provided a new way of looking at the universe: the universe is a place *where reality is shaped by the participation of the observer*, a web of interactions in which everyone participates. Chaos and order are not polar opposites but part of a cyclical continuum, and concepts of *wholeness* and *oneness* are key. An understanding of these basic concepts and others which result from the New Sciences have made an impact on late twentieth century business people through the works of Peter Senge (1990) and Margaret Wheatley (1992), among others. Little work has been done, however, to make theoretical applications in education, although the basic concepts have now been available for over a century.

In 1958, Northrop called the philosophical applications of quantum physics “the major event in today's and tomorrow's world.” The implications of quantum mechanics have shaken the world of science with an impact equivalent to the effect of Newton's

laws of motion. So let us try to distinguish the difference between the Newtonian worldview and the quantum world view, as the basis for the paradigm shift.

One key concept in the paradigm shift is the difference between Newtonian physics of forces in objects in motion and objects at rest; and quantum physics, which deals with the operations of subatomic particles and waves. Newtonian laws of motion and concepts of gravity have not been supplanted by quantum mechanics. But quantum mechanics operate in a different sphere—the realm of the subatomic.

In brief, the “Newtonian worldview” presented in the scientific literature sees the world and its forces as a “clockwork universe” which is ultimately knowable. Scientific method is the way to achieve knowledge. Continual refinement of ideas will ultimately achieve the goal.

By contrast, our understanding of quantum mechanics rests on two paradoxes (which will be explained in greater depth in Chapter III):

1. subatomic matter can take the form of either waves or particles, and
2. what one sees (wave or particle) is determined by what one looks for!

The notion of the scientist as an “objective experimenter” removed from her experiment is called into question by the realities of quantum experiments. Thus quantum physics has brought to “the respective philosophies of culture of mankind” (Northrop, 1958) a new view of reality that emphasizes the *connection, integration, and wholeness* of all parts of the system. That view stands in stark contrast to the Newtonian worldview, which emphasized further and further subdivisions of parts in order to understand the whole.

A major purpose of this dissertation is to examine the paradigm shift brought about by the New Sciences and their applications to the concept of leadership in education, especially in relationship to change. The beginning of Chapter II: *Review of Literature* will provide a broad historical review of these key discoveries of 20<sup>th</sup> century science, assuming little or no familiarity with the key scientific concepts, also briefly defined in Table 1, pages 4-7.

#### Systems Theory: A Key to Understanding Organizations

An understanding of systems theory—which grew out of the scientific notion of *fields* and is supported by the quantum notions of *complementarity* and *connectedness*—is essential to a basic understanding of organizations. Systems theory is generally credited to Bertalanffy (1968) and is further elaborated in Laszlo's 1972 publications—*Introduction to systems philosophy* and *The Systems view of the world*. Laszlo focuses on the “new scientist” who “concentrates on structure on all levels of magnitude and complexity, and fits detail into its general framework” (*Systems view*, p. 13). Most importantly, the new scientist looks at the context of situations and the interrelationships that shape and influence those contexts (p. 13). The discoveries of quantum physics had led to a systems view of the universe, so Laszlo concludes, “If we are to understand what we are, and what we are faced with in the social and the natural world, evolving a general theory of systems is imperative,” (pp. 13-14).

Laszlo has commented on the “remarkable parallelisms” (*Systems view*, p. 27) in scientific theories that have led to the development of systems understanding across scientific disciplines, and by extension, across social sciences as well. It is worth it to pursue the characteristics of such systems as laid out by Laszlo in *Systems view of the*

*world* because these four “organizational invariances” (p. 27) have come to be accepted by organizational theorists who take a systems view of organizational structure (as do Senge, 1990; and Wheatley, 1992).

Reviewing Laszlo’s systems principles will lay a foundation of understanding for this research. Laszlo begins with physical science illustrations for each systems principle, and then extends the principles to connect to organic (life sciences) and supraorganic (social sciences).

Natural Systems Are Wholes with Irreducible Properties (p. 27).

Unlike a heap of bricks, as Laszlo suggests, the character of which does not change with the addition or removal of an individual brick or two (p. 28), a system is “an entity having some formal structure built on the basis of an interdependence among its parts” (p. 28). The whole that the system represents has an identity that a single part of that system cannot represent on its own.

Natural Systems Maintain Themselves in a Changing Environment (p. 34).

It is necessary to define open system vs. closed system to come to an understanding of this principle. Open systems have an exchange of energy or resources across system boundaries; closed systems (which are actually quite rare in the natural world) are self-sufficient—no energy crosses their boundaries. Thus Laszlo posits the human being as “an open natural system; so are the cells that compose his body, and the ecologies and societies which he constitutes jointly with his fellow human beings and organisms” (p. 37-38). Human beings interact with a changing environment, yet they maintain themselves and their identities.

Natural Systems Create Themselves in Response to the Challenge of the Environment (p. 46).

It's clear that many entities grow, change, and adapt to changing circumstances in their environments. It is in this section that Laszlo addresses the "thorny" (p. 47) question of *purpose* in evolution, concluding that as "innovations" in adaptation or in response to the system are randomly generated, some are successful, while others pose no advantage to the organism, and thus fall by the wayside. The changes which are integrated into the system reduce chaos and create order (p. 49).

Even within large, adapted systems, the individual parts still maintain autonomy and freedom to make decisions (p. 51). It is precisely in this way that this systems view of the world differs from the Newtonian worldview. Newton would have seen each part responding "like that of cogs within a machine," (p. 51), but the systems view sees a dynamic structure in which a part of the structure (organization, or organism) faced with a certain stimulus from the environment can respond independently and meaningfully. Laszlo concludes that evolution has "purpose without slavery, and freedom without anarchy" (p. 52). The system moves in response to its environment toward a state of greater oneness and order.

Natural Systems Are Coordinating Interfaces in Nature's Hierarchy (p. 67).

An understanding of hierarchy is important to any discussion in which organizational management is going to be a part. How do the parts relate to each other in a system, and who makes the decisions? Laszlo defines hierarchy in nature this way: each natural system is a part of the whole—since the suborganic, organic, and

superorganic all function in a similar way. Within the whole, each part of the system provides a link to the levels below and above in the natural hierarchy:

Organization in nature comes to resemble a complex, multilevel pyramid, with many relatively simple systems at the bottom and a few (and ultimately one) complex system(s) at the top. Between these limits all natural systems take intermediate positions; they link the levels below and above them. They are wholes in regard to their parts, and parts with respect to higher-level wholes (p. 67).

Laszlo goes on to explain the advantage of hierarchical systems in evolution and adaptation: “those that succeed in survival and growth are the ones that can cut losses and start rebuilding again” (p. 68). That happens more quickly in hierarchical systems—particularly when the individuals in the hierarchy are adaptable to many roles and functions—whereas nonhierarchical systems “come completely unstuck, disaggregating to their elementary constituents” (p. 68).

#### The Human Individual’s Role as Part of a System

Principle 4, above—relating to hierarchy—is critical to an understanding of the role of the human in organizations, as Laszlo explains:

Physiologically man is an individual whole, whereas sociologically he is an integrated (or a recalcitrant) part. And since man is endowed with consciousness, psychologically he is both whole and part—a duality which, when not recognized as an interface coordination, can lead to confusion and distress (p. 72).

Understanding the connection in a world of increasing change means being able to shift roles quickly so that the whole continues to function. As Laszlo says,

A hierarchically integrated system is not, therefore, a passive system, committed to the *status quo*. It is, on the contrary, a dynamic and adaptive entity, reflecting in its own functioning the patterns of change in the entire hierarchy (p. 74).

From these key understandings of scientific systems, Laszlo proposes that we must have a “systems view of man” that “links him . . . with the world he lives in”

(p. 79). Man is “a natural entity, and an inhabitant of several interrelated worlds. By origin he is a biological organism. By work and play he is a social role carrier. And by conscious personality he is a Janus-faced link integrating and coordinating the biological and the social worlds” (p. 79). In this discussion, the notion of *complementarity* (see Table 1, p. 5) is implicit, though Laszlo does not mention it specifically.

In his discussion of man’s role in the natural system, Laszlo emphasizes the importance of consciousness:

In developing the rudiments of consciousness, our ancestors exploded the limits of genetically programmed behavior. They learned to learn from experience. By reflecting on the events of a hunt, for example, they could abstract its relevant elements and compare them with other occasions. They could select the most successful pattern of behavior and adopt it. Mere subjectivity is bound to the immediacy of events; only consciousness can liberate one from his actual experience and enable him to control it by his own will. (p. 95).

In his emphasis on the role of the individual *will*, Laszlo lays the foundation for the control theory of William T. Powers (1973), which will be a key to an understanding of motivation and connection in education. A more detailed discussion of this concept will be found in Chapter V: New Science Research and Methodology.

It is through this application of *consciousness and will* that the role of leadership becomes a possibility. Systems do not have to be rigid, pre-ordained entities that deny free will and lock both leader and follower into limited roles forever: there is a role for *conscious choice* both on the part of leaders and followers; it is not even necessary that one single person must always play the role of *leader or follower*—those roles may be exchanged as suitable to the survival of the whole system. The more quickly the organizational hierarchy can adapt to those shifts and role changes, the greater its

likelihood of long-term survival and success in diverse and constantly changing circumstances.

The systems of which humans are a part are “dynamic” rather than “mechanistic”—and thus, Laszlo asserts, we may reject the determinism of behaviorists like B.F. Skinner (p. 112):

The components of natural systems form something like democracies in which it is agreed that certain functions will be carried out, but where it is left up to volunteers to fulfill them. It matters not in the least which particular component carries out a task. What particular function a component performs is also determined by the kinds of functions performed by the others. . . . The system as a whole is determinate, but the relationship of the parts is not. This is not the mechanistic determinism of old-fashioned behavioral scientists, but the flexible, dynamic “macrodetermination” conception of contemporary systems biologists, psychologists, and social scientists. (p. 113)

This understanding of human systems leads away from the mechanistic view of little people locked into restrictive roles, and towards a concept of human fulfillment:

“Fulfillment is predicated upon the freedom to become what one is capable of being—that is, upon the functional autonomy of human beings in society” (p. 115).

Although Laszlo was not specifically making reference to schools, it is clear that most schools take as their central purpose the development of functional, autonomous human beings in society.

In order for complete functioning within such systems, human beings need to be able to observe how closely the actual values operating within a system come to the norms which are part of the system. “For only if we know both where we are and where we want to go can we act purposively in seeing about getting there” (p. 117). In terms of education, this means establishing feedback loops with assessment data and responses built in at every opportunity.



Laszlo concludes that “The supreme challenge of our age is to specify, *and learn to respect*, the objective norms of existence within the complex and delicately balanced hierarchic order that is both in us and around us. . . . [T]here is no other way to make sure that we achieve a culture that is viable and humanistic” (p. 120). Principals of schools surely share the desire to create viable and humanistic organizations, rather than moribund and irrelevant institutions.

#### Systems Theory as Presented by Business Writers

Senge (1990) and Wheatley (1992)

Two major business organization writers of the late 20<sup>th</sup> century have provided the foundation for this dissertation: Peter Senge (1990) and Margaret Wheatley (1992).

Systems thinking, derived from New Science principles, has become part of common parlance in the business world, largely through the works of Peter Senge and his various co-authors (1990, 1999, 2000). Systems thinking *is* the *Fifth Discipline* (Senge, 1990).

In the thirteen years since *Fifth Discipline* was first published, Senge’s ideas have received wide reading, and his book has brought the scientific concepts of systems thinking to the business world. The book has sold more than 750,000 copies and was named “one of the seminal management books in the last 75 years” by *Harvard Business Review* in 1997 (Sparks, 2001, p. 43). In 1999, *The Journal of Business Strategy* named Senge as one of the 24 people “who have had the greatest influence on business strategy over the last 100 years” (Sparks, p. 43).

Senge has gone on to publish a series of “Fifth Discipline” Resources and Handbooks, including a book that specifically addresses the process of change in

organizations—*The Dance of change: The Challenges to sustaining momentum in learning organizations* (1999, with Kleiner, Roberts, Ross, Roth, & Smith)—and a book specifically aimed at schools, *Schools that Learn: A fifth discipline fieldbook for educators, parents, and everyone who cares about education* (2000, with Cambron-McCabe, Lucas, Smith, Dutton, & Kleiner).

Educators have taken note: the model of systems thinking is a powerful one for understanding the complexities of modern organizations. Its explanatory power may enlighten our understanding of how schools work as well as how large (and small) business organizations function.

Two years after Senge's *Fifth discipline*, in 1992, Margaret Wheatley interpreted her understanding of the scientific principles of quantum physics and chaos theory in a book for a business audience: *Leadership and the new science*. She proposes those key concepts of quantum physics and chaos theory as a metaphor for understanding business leadership. Together Senge and Wheatley make a powerful case for looking at business operations in quite a new way, suggesting that the old hierarchical factory model—an artifact of Newtonian thinking—be discarded in favor of a model that is not only more holistic and more humanistic, but more in harmony with what the latest understandings of science tell us about the nature of the world.

Wheatley (1992) and Senge (1990) bring us to a common understanding of leadership, interpreting the New Science in terms of human business organizations. *What if*, Wheatley proposes, we were to view our human organizations *as if they operated on quantum principles*? How would they be different from the way we typically have seen them? And how would our conception of leadership change in this New Science

perspective? In Chapter IV, we will address this question of the educational leader more specifically.

### The Contribution of Chaos

In Western culture since the time of the ancient Greeks, “chaos” has meant the antithesis of order—the disintegration of pattern and control which is universally hated and feared. These strong associations have caused most mathematicians and scientists who work with chaos theory to refer to their work more neutrally as the investigation of nonlinear dynamics.

In this dissertation, “chaos” will always carry its New Science meaning: I will use that term and revel in the paradoxes that its connotations bring, as did Hayles (1990) in *Chaos bound: Orderly disorder in contemporary literature and science*; and Kellert (1993) in *In the wake of chaos: Unpredictable order in dynamical systems*. As their titles suggest, the paradox is in the patterns formed by iterations of nonlinear equations, producing the patterns when graphed in four dimensions.

A key concept is the idea of the *complexity* that exists *at the edge of chaos*. We will look at a definition here, as it is a key New Science concept which we need to understand to comprehend the process of change and evolution within organizations. Waldrop (1992) points out that scientists and social scientists in many fields have been investigating the *edge of chaos*—

[where] the components of a system never quite lock into place, and yet never quite dissolve into turbulence, either. . . where life has enough stability to sustain itself and enough creativity to deserve the name of life. . . where new ideas and innovative genotypes are forever nibbling away at the edges of the status quo, and where even the most entrenched old guard will eventually be overthrown . . . . The edge of chaos is the constantly shifting battle zone between stagnation and anarchy, the one place where a complex system can be spontaneous, adaptive, and alive. (p 12).

In recognizing and investigating—under the rubric of *complexity*—the special nature of this zone where changes take place, researchers in various fields have begun, as Waldrop says, to “[forge] the first rigorous alternative to the kind of linear, reductionist thinking that has dominated science since the time of Newton—and that has now gone about as far as it can go in addressing the problems of our modern world” (p. 13). Thus *complexity*, used in this way, is a key concept which has developed from the new scientific and mathematical understandings of the 20<sup>th</sup> century, and the fact that it exists as a new field of study is a result of this same scientific revolution. Complexity can aid understanding of how change takes place within adaptive organizations (schools), and complexity also relates to the role of leadership in connection with those schools. Literature relating to the concept of complexity is expanding daily. Future researchers will find this a fruitful investigation.

### Defining the Paradigm Shift

This dissertation is conceptual in nature. The *New scientist*, as Laszlo (1972, *Systems view*, p. 73) defines it, focuses on “structure on all levels of magnitude and complexity” and searches for the framework into which all “atomistic facts and events” can be fit. In the New Science view, we must accept that there is *no* one-size-fits-all model for excellence—in schools or in leadership of schools. For leaders to be effective, they must continually strive to *see* the myriads of systems of which their domain is a part. Senge, et al., (2000) has partially revealed those interlocking systems in his diagrams of school systems in *Schools that learn*. (See Appendix B, Figures 1, 2, and 3.) The conceptual portion of this dissertation provides a New Science lens through which the

process of education and the role of educational leadership can be viewed. Once the worldview has shifted, everything looks different.

Applied Research: Investigating Change and Leadership  
at Two New Hampshire High Schools

The applied research part of *this* study will focus on teachers' and principals' perceptions of the process of change, the role of leadership in change, and a model of leadership developed through the application of New Science concepts researched at two secondary schools—Edgetown and Middletown—within thirty miles of each other. Both are grade 9-12 comprehensive high schools with populations of over 1000 students. Edgetown is a school at which substantial changes and re-structuring occurred between 1992 and 2002; at Middletown High relatively few significant changes occurred between 1992 and 2002. Both schools did undergo a renovation/expansion during that period. Each of the schools had 3 different principals during the 10-year period under study.

The research tool was a 36-item survey of leadership qualities developed from Senge's (1990) leadership "disciplines." It was administered to volunteer teachers at each school, asking them to reflect retrospectively on the leadership qualities of the three principals who served each school during the ten-year period from 1992 to 2002. At Edgetown, forty respondents out of a possible pool of 66 completed surveys in June, 2002—representing a 60% return; at Middletown, 27 respondents out of a possible pool of 88 returned surveys in September, October, or November of 2002—representing a return rate of 30%.

The researcher is a member of the high school teaching staff at one of the high schools and is a participant/observer in the study.

In addition to looking at how teachers view the leadership patterns of their principals, the survey asks teachers to assess

- (1) the types of changes and amount of change at their school,
- (2) the teacher's attitude toward specific changes at the school and to change in general.

A separate but parallel survey was given to the five principals during a face-to-face audio-taped interview with each principal. (One principal served a tenure at both of the schools in the study.) During the interview, each principal was asked to reflect upon

- (1) the principal's view of his or her own leadership style or pattern,
- (2) the principal's view of his or her role in school change,
- (3) the principal's analysis of the benefits of changes instituted.

As a means of following up on survey data, twelve focused interviews were conducted with teachers—six from each school—asking them to comment on the principals as leaders in their school. These interviews were audiotaped and transcribed.

#### Research Questions

As mentioned in Section I of this chapter, the overall research question for this project is *How does the New Science way of looking at the universe affect the 21<sup>st</sup> century conceptualizations of schools, educational research design, and school leadership?*

#### The Conceptual Part of New Science Leadership in Education

The conceptual part of this dissertation will propose answers to these questions.

1. *How do the scientific understandings derived from the New Sciences provide valid understandings of the real world?* To accept the assumption of valid understandings

posed by the question may be the biggest step for those who have not been following the developments in science and math, or for those not current in business models which follow Senge (1990) and Wheatley (1992). But beginning with Heisenberg (1958), proofs and philosophy have collected to support the validity of quantum physics and chaos mathematics. The foundation for this proof is in this introductory chapter, and will be further elucidated in Chapter II: Review of Literature, and Chapter III: From New Science to Organizations to Schools.

*2. How can New Science understandings serve as meaningful models for understanding human organizations—how they function, and how they change?*

Laszlo's work (1972, *Systems view*) clearly establishes the connection between the scientific experiments (suborganic), the human models (organic), and the societal models (supraorganic). Senge (1990) and Wheatley (1992) have taken the concepts and illustrated clearly how applicable they can be to the world of the business organization. In Chapter III, I will argue that schools, and school systems, are also organizations to which these same principles can and do apply.

*3. What model for understanding educational leadership is appropriate for the twenty-first century?* In Chapter IV: A New Science Model for the Educational Leader, I develop a model of educational leadership in the twenty-first century based on Burns (1978), Alinsky (1946/1969; 1971), Senge (1990) and Wheatley (1992/1999).

*4. What are the New Science implications for school and leadership research?* A very few educators have made some initial steps in this direction; those contributions will be discussed in brief in Chapter II: Review of Literature. Curriculum development, teacher development, and many of the most current learning theories can be related to

New Science thinking; in fact, the New Science ideas provide a framework which embraces many educational ideas already in practice. Chapter V: Conceptual Framework and Methodology will lay out the implications for research in education. Research Questions for the Empirical Part of the Study

5. *What meaningful insight can be gained from retrospectively observing the interaction between change and leadership style at two New Hampshire high schools?*

6. *How did the intentions and styles of the leaders influence change at the two sites?* Chapter VI responds to questions 5 and 6, above.

#### Dissertation Preview

This introductory chapter lays out the framework for the dissertation, and provides a basic introduction to systems thinking and to the concepts of New Science that make up the new paradigm.

Chapter II, Review of the Literature, will examine key literature relevant to the topics of leadership and New Science concepts, and the education and social work research relevant to these topics.

In Chapter III, From New Science to Organizations to Schools, the ideas of New Science, especially quantum physics and chaos theory, are explained, looking at how the revolution in scientists' thinking about the nature of the real world—in essence *a new world view* has been created: new, at least, in the Western world since the time of Newton. As Laszlo has demonstrated (*Systems view*, 1972), these New Scientific understandings do, in fact, represent “the way the world is.” The generalizations about the microscopic, atomic-level reality can and do have relevance to our understanding of reality in schools, as examples of organizations.



In Chapter IV, A New Science Model for the Educational Leader, the systems thinking of Senge (1990) and the leadership applications of Wheatley(1992) are introduced. These models intended for CEOs in the world of business have valid and useful applications in the field of educational organization and leadership.

Chapter V, Conceptual Framework and Research Methodology, demonstrates how constant awareness of the complexity of the school situation (see Figure 3 in Appendix B) changes the way educators should conduct experiments. The paradigm shift described herein must alter traditional research designs, practices, and methodologies. The analysis provides the basis for this particular study.

Chapter VI: Findings: Edgetown and Middletown, will examine change at the two schools, analyze the survey data, and sketch out leadership profiles of the five principals interviewed at Edgetown and Middletown. The data will provide an exploratory look at the combination of leadership style and the change processes at the two schools in the ten year period from 1992 to 2002.

Chapter VII, From Clockworks to Whirlpools: Discussion, Conclusions, and Directions for the Future, will draw conclusions from the study and from the conceptual part of this dissertation and propose areas for more investigation.

### Conclusion

The scope of this dissertation is broad: it encompasses studies in physics, mathematics, sociology, business organization, and education. It focuses on establishing connections between quantum theory and chaos mathematics as metaphors for understanding the reality of educational institutions (by way of applying the business theories of Senge and Wheatley to schools as institutions). Building on that foundation

and the historical theory of leadership posited by Burns (1978), it proposes that the educational leaders we need today need to be *transformational leaders* (Burns' term) who can understand and lead schools forward in the ways that Wheatley (1992) suggests in *Leadership and the new science*.

The applied research portion of the dissertation will seek to understand teachers' and administrators' perceptions of how leadership during the ten-year period from 1992-2002 has influenced the change process by looking at one specific high school setting where much change has taken place, and contrasting those results with data from another school where change has been slow.

Finally, the dissertation explains current educational reform and change efforts in terms of quantum theory and chaos theory, looking especially at how New Sciences understandings change the views of appropriate research models in education and the epistemological questions relating to how we know what we know. That basic educational question underlies everything in the process of education. The goal is to take each reader to the other side of the paradigm, as we shift into a new world of educational leadership for the twenty-first century.

## CHAPTER II

### REVIEW OF LITERATURE

The whole universe appears as a dynamic web of inseparable energy patterns.—(Fritjof Capra, *The Tao of physics*, 1985, p. 80).

The ideas of New Science behind this dissertation are part of the research literature from many fields: for understanding of the New Science concepts themselves there were books in quantum theory and chaos theory; for the leadership concepts, literature from history and political science as well as business and organization sources; for research applications relevant to the focus of this dissertation, sources from the field of social work as well as education. The breadth of the concepts and the numbers of disciplines incorporated is both a strength and a weakness of the study: a strength because this broad review indicates the relevance and importance of these concepts in many fields; a weakness because it is impossible to read *everything* in every field. One cannot focus “in depth” on everything at once.

Because the next three chapters are conceptual in nature, they include detailed references and discussion of key source material. In order to save space and avoid repetition, these sources will be omitted in this chapter on the review of literature.

New Science concepts do provide a justification for how a careful, close examination of one aspect of a system can allow us to draw conclusions on the system and on its history as a whole. Thus the following chapter will be more than a review of names and articles in education. It will elucidate key contributions and understandings across many fields which will make the following three chapters--Chapter III: From New

Science to Organizations to Schools, Chapter IV: A New Science Model for the Educational Leader, and Chapter V: Conceptual Framework and Methodology—even more persuasive.

### New Science Sources

#### Quantum Theory

##### Quantum Physics: An Historical Overview

Many physicists' and mathematicians' combined contributions were necessary in order to move ahead with quantum mechanics. Einstein's early work at the dawn of the twentieth century was groundbreaking. His first published contribution to the new ideas of physics were his special theory of relativity and theory of atomic phenomena, published in 1905; in 1915, he proposed the general theory of relativity, which included gravity. By 1926, the physicists of the world (including Bohr, Shrodinger, Heisenberg, Einstein, and others) came together in Copenhagen to discuss the new ideas of physics. As Heisenberg (1958) reports, the physicists who participated in the Copenhagen discussions pondered their conversations carefully in the ensuing months, finally coming to "a complete, and, as many physicists believe, satisfactory clarification of the situation. But it was not a situation which one could easily accept. . . . I repeated to myself again and again the question: Can nature possibly be as absurd as it seemed to us in these atomic experiments?" (p. 42).

Year by year since the 1920's, those "absurd" ideas of quantum physics have penetrated other branches of science, with implications in chemistry (Prigogine, 1998; 1984), and biology (Capra, 1996; Gould, 1980). Those new understandings have led to an idea of physics that goes beyond Newton, and to an attempt to integrate our

understanding of the microscopic world of atomic parts not only with the world that we live in, but also with the macroscopic world of the stars and planets.

Thirty-two years after the Copenhagen convocation, Heisenberg published *Physics and philosophy* (1958), in which he clearly lays out the principles of quantum physics and explains how new understandings of quantum processes have changed physicists' perceptions of reality. He makes the point that it had taken more than twenty-five years for physicists as a whole to come to a "real understanding of the quantum theoretical laws. This indicates the great change that had to take place in the fundamental concepts concerning reality before one could understand the new situation" (p. 43).

This new way of understanding reality—based on the concepts of quantum physics and on chaos theory (to be discussed later)—are the basis for this dissertation. For since Heisenberg published *Physics and philosophy*, nearly another half century has passed; yet among the general public, among many teachers and administrators, the "old ways" of thinking about the world and how it works still dominate in schools where practices and curricula are locked into rigid annual cycles, risk-taking is discouraged, and a strictly hierarchical model of decision-making and leadership is the norm. How can the vast and significant changes in philosophy of science have had so little effect on schools and school leadership?

The change in thinking relating to quantum physics has taken more than seventy-five years; the revolution with regard to applications of chaos theory has also been slow (see Kellert, 1993). Why has it taken so long? Because scientific thinkers and other philosophers have been mired for so long in the analytical thinking of Newton: the mathematicians didn't read the work of the physicists; the chemists were unaware of

what was going on in biology (Gleick, 1987); outside of the Research and Development laboratories, some business people were scientifically and mathematically illiterate. The Newtonian worldview posits a world which is ultimately knowable, with scientific specialization encouraged and fostered. New Science thinking, on the other hand, emphasizes holistic systems thinking, an emphasis on the big picture. But for specialists, it's sometimes hard to keep the big-picture view.

And in the public schools, the curricula may have been as much as twenty-five years behind the scientific developments taking place in the laboratories around the world—depending upon the curricular commitment to keeping current within individual high school science and mathematics departments.

#### Quantum Theory Sources

Wolf (1989) provides a general introduction to the key definitions and paradoxes of quantum theory. Aspects of these ideas are further clarified by consulting Wallace (1996) and Lindley (1996).

Capra's *The Tao of physics* (1985) not only gives a clear explanation of quantum mechanics, but also helps to focus the connections between Eastern thought and concepts of quantum mechanics that have made the paradoxes of quantum ideas less puzzling for those raised in Eastern religious and/or philosophical traditions: the concept of *yin* and *yang*, for instance, as both being necessary for completion (in contrast to the Western dualities of good and evil, order and chaos, with the idea being to choose good and eschew evil); the idea of the unity and interrelation of all things and events; the idea of a single unified field in which all events are connected; the idea of being one with the

universe. These are all familiar ideas to Eastern thinkers, though some of them would certainly give pause to a Western, Newtonian thinker.

#### Systems Theory: A Key to Understanding Organizations

Systems theory—as discussed in Chapter I—has its roots in the scientific concept of “field” (See Table 1, p. 5-6). Many general readers have been introduced to systems thinking through Senge’s (1990) *Fifth discipline*, but Bertalanffy (1968) is credited with the first complete articulation of systems theory as it might apply to fields other than the scientific. As detailed in Chapter I, Laszlo (1972a) and (1972b) broadened the applications, positing the extension of the scientific “system” to the system of the individual, and then to the system of society.

The psychologist and educator Runkel (1990) finds fault with this “pan-systemic view” (p. 155), because, he says, the instances are so rare when members of a group actually share group goals and act in concert to achieve them (he acknowledges successful sports teams and performing groups as exceptions when shared goals do result in an enhanced outcome). Groups are made up of individuals, each of whom operate under certain beliefs and values, and Runkel believes those individual motivations are the controlling factor. Some of these values may sometimes be shared. For Senge (1990), it is the job of leadership to find ways to focus individual goals and perceptions on the “shared vision” for the company. If successful, such a strategy does move the group forward in unusual and exciting ways. Though such shared vision may be rare, it has happened through conscious planning and leadership often enough to be documented, and the results are gratifying—not only in terms of possible bottom line gains, as Senge (1990) points out, but also in the ways people who are part of such systems feel about the

value of their work. More detailed discussion of these ideas will be found in Chapters III and IV.

### Chaos Theory

A basic understanding of chaos theory can be acquired through science writer James Gleick's *Chaos* (1987), which takes an historical approach to the development of chaos theory concepts. Briggs and Peat (1989) emphasize the metaphors and the concepts which begin to shift with an understanding of nonlinear dynamics with their title:

*Turbulent mirror: An illustrated guide to chaos theory and the science of wholeness.*

Smith (1998) clarifies ideas for the non-specialist.

Prigogine and Stengers' *Order out of chaos* (1984) emphasizes the patterns in chaos—not only fractal iterations, but also strange attractors. Prigogine's 1998 title, *The End of Certainty: Time, chaos, and the new laws of nature*, focuses on a key aspect of the shift from a Newtonian worldview to a New Science view: that is, we have moved from a view that assumes that everything can be known to a world where we must acknowledge many things we can not know. *Probability*, rather than *certainty*, becomes the key concept.

The gifted science writers mentioned above have presented provocative ideas in understandable form, often making use of metaphor and paradox. Writers in other disciplines have also investigated chaos in useful ways. Hayles (1990; 1992) makes connections in literature; Kellert (1993) analyzes the impact of chaos theory on scientific thinking and philosophy in his book *In the wake of chaos*.



### Relevant Social Science Research

In addition to the works mentioned above that form the framework for this theoretical study, some works in social work journals have laid the groundwork for applications of chaos theory to social science research. Social work as a field is closely related to education because it is concerned with teaching coping strategies to individuals and groups; social workers share with educators the concerns related to how people learn. All of the articles selected for review are relevant to educational systems as well as to social systems.

Three social work studies have investigated ways in which chaos theory can be used for social work research. Their conclusions are equally applicable for education and for research methodology in education, as well. These three groups of researchers conclude that social work situations are nonlinear and make specific suggestions about research models in an examination of such situations, emphasizing qualitative procedures as preferable to quantitative.

Gregersen and Sailer (1993)

In their article in *Human relations*, Gregersen and Sailer (1993) present a clear description of the mathematical principles relevant to chaos mathematics, providing graphs of data points to illustrate the difficulty of applying traditional, normative statistical procedures to systems which are nonlinear: because the statistical procedures are not appropriate for nonlinear happenings, "cross-sectional research on inherently chaotic phenomena may actually produce an illusion of certainty (i.e., prediction) for a social phenomenon with underlying unpredictability"(pp. 785-786). Their graphs make

this point clearly. (See Chapter V, Figure 5.1: Four Hypothetical Studies of a Chaotic System).

Gregersen and Sailer's (1993) findings also relate to the process of change. They argue that chaos theory arguments can apply to a wide variety of social systems, especially those with "areas of discontinuous, unexpected, or unpredictable change" (p. 781), such as "transformation systems." The authors suggest some specific types of transformation systems in which some work has already been done in terms of chaos theory, including organizational decline, decision making, work role transitions, and organizational change. All of these categories are directly applicable in school settings.

Perhaps most significant is Gregersen and Sailer's (1993) conclusion that many (if not most) social systems are naturally nonlinear, and thus chaotic; therefore, they are inherently unpredictable. Thus we must turn our research goals away from the desire to make *predictions* and seek instead to emphasize *understanding*: "the research goal of understanding is the only viable objective when studying chaotic social phenomena" (p. 798).

If one accepts Gregersen and Sailer's (1993) claims about the chaotic nature of social systems, one can then accept their implications for social science research, which will be discussed in more detail in Chapter V on research paradigms. Basically, Gregersen and Sailer conclude that "the question is not simply whether or not chaos exists, but the degree to which chaos occurs and the degree to which such chaos is relevant to particular research questions" (p. 794), and that "qualitative methods will increase in importance when studying potentially chaotic social systems" (p. 797).

Warren, Franklin, and Streeter (1998)

Warren, Franklin, and Streeter (1998), writing in *Social work*, do an excellent job of describing the nonlinear nature of complex human systems. In this way, they say, social work is an appropriate field for applying chaos theory as the most recent twist on systems theory. The authors give a clear, compelling explanation of nonlinear processes, using the human learning process as an example:

Learning is a nonlinear process—one that applies to individuals and, it has been argued, organizations as well (Senge, 1990). At first it goes slowly, as we ‘learn the ropes’ or ‘learn the basics.’ We accumulate knowledge of our chosen subject in a way that we relate the new knowledge to that which we already have. Thus, our learning curve grows steeper. We begin to learn more easily.

Nonlinear growth cannot continue forever, though, because it will eventually bump up against resource limitations that will flatten the growth curve. (p. 360).

This persuasive description of the learning curve, easily recognizable by teachers as an accurate one, makes it clear that the learning process is nonlinear.

The authors continue, describing the butterfly effect and other feedback loops which may constrain learning in systems, concluding that “the sorts of feedback systems that give rise to nonlinearity and deterministic chaos are extremely common among living systems, including human social systems” (p. 363). Because the curve rises so steeply in nonlinear systems, “a small input can bring about a large output, if the input occurs at the right time and the right place” (p. 364). The authors give revolutions as an example. (They don’t cite Alinsky [1971], but he would certainly agree that the right intervention at the right time can begin a revolution. More on that in Chapter IV, Leadership.)

Warren, Franklin, and Streeter (1998) go on to suggest the ways that chaos theorists would change systems theory as it applies to social science. Instead of emphasizing the orderly and stable characteristics of systems, with words like

*homeostasis* and *equilibrium*, chaos theorists would emphasize *path dependence*, a result of the butterfly effect:

*Path dependence* is a result of the sensitivity that nonlinear systems show to initial conditions. It implies that systems that start in a nearly identical state can develop in completely opposite directions as the system amplifies initially minor differences. (p. 365).

Warren, Franklin and Streeter (1998) continue by discussing ways in which these understandings of nonlinear systems have relevance to social work; these same connections have application to education in terms of classroom strategies and/or the initiation of the change process in an educational system. For example, if a system is in an “edge of chaos” state (see Table 1, pp. 4-8), “a very small intervention can have a very large effect” (p. 368). The same intervention might have little or no effect in another situation. The implication for teaching (and leading) is that it may not be the *intervention* which fails—it’s the *situation* which is not ready or ripe for it. The key to choosing the “right” intervention thus becomes close and accurate reading of the individual situations.

Similarly, Warren, Franklin and Streeter suggest, our notion of human response to change may shift as a result of this shifting paradigm:

If a chaotic period is a normal part of many human change processes, then a certain disequilibrium, possibly including unpredictable reactions, sudden changes in thinking and behavior, and distressing emotions, may also be a necessary part of those human change processes. If this were true, then human distress would not always be pathological; it would need to be judged in the broader context of the individual’s unfolding life. (p. 368).

The application to individual learning is clear: students often experience a period of disorientation, possibly performing previously learned skills less well, as they acquire and integrate new skills before achieving mastery.

The authors reflect on research methods that are appropriate in nonlinear systems, concluding that qualitative measures may prove more fruitful than quantitative, citing Gregersen and Sailer's (1993) conclusions. In addition, they suggest that time series—especially repeated measures with single subjects—may lead to a better understanding of change in social work terms.

Hudson (2000)

Hudson (2000), writing for the *Journal of Social Work Education*, has apparently not read Warren, Franklin and Streeter (1998), or at least has not cited them, but is on the same page, suggesting that chaos theory may provide “a new paradigm for social work.” He outlines the difficulties of systems theory as a foundation concept in social work, stemming from the “common assumption of equilibrium” (p. 218), which he claims “is a misunderstanding of general systems theory, one due in part to an inadequate grasp of the dynamics of feedback loops” (p. 218).

Hudson (2000)—like Gregersen and Sailer (1993) and Warren, Franklin, and Streeter (1998)—suggests that “actual research on chaotic processes usually requires extensive time-series data. . . . [and] an understanding of calculus” (p. 227). He concludes that it is “premature” to hail chaos theory as a new paradigm for social work professionals, if only because it is still used so infrequently (whereas in psychology indexes, many more research articles can be found dealing with the topic).

But it is also clear that both the concepts and methodologies of chaos theory promise to significantly extend the profession's ability to understand the increasingly complex systems in which it is regularly asked to intervene, moving us beyond the limitations of general systems theory” (p. 228).

Taken together, these studies underscore the nonlinear nature of social settings (and schools) and the value of chaos theory as an investigative research tool.

## New Science in Educational Research

Several studies focus on systems theory, chaos theory, and school leadership, connecting to *educational research design, school change and reform, curriculum planning, and educational leadership*. Even though we have used these subheadings as a way to organize the review of research literature, we will recognize that there is an overlap among topics, and that in a systems approach, leadership does influence curricula and vice versa; school change and reform cannot be discussed without also discussing the role of the leader and/or change agent. In fact, even when an article's main focus is *curriculum*, for example, often there is specific mention or reference to *leadership*.

### Educational Research Design

Although systems theory has been a key concept for thirty years, chaos theory applications have only recently begun to be investigated. Nearly all citations in education publications are within the past ten years. A few early writers deserve special mention: Cziko (1989; 1992), Runkel (1990), and Sungaila (1990).

Cziko (1989) raised the issue of the suitability of quantitative models of research for education. His follow-up article in 1992 cites Runkel (1990). Both Cziko (1992) and Runkel (1990) cite Powers' (1973) Perceptual Control Theory as a way of explaining motivation and free will within the systems framework.

Cziko (1989 and 1992) and Runkel (1990) write for an audience familiar with quantitative statistics. Sungaila (1990), by contrast, works with the metaphors of New Science. Writing before Senge (1990) and Wheatley (1992), she begins with the assumption that "educational systems are dissipative structures" (p. 4), and proposes school leadership as part of the educational system's "self-organisation dynamic" (p. 4),

enthusiastically suggesting that “at last a scientific, not a pseudo-scientific understanding of the way our world works appears to be within our grasp” (p. 4). Later in the article she elaborates on that distinction between scientific and pseudo-scientific in a passage that is puzzlingly contradictory:

It is important to stress that it is not merely by way of analogy that the dissipative structure is being discovered in all these different systems. Though the natural and social phenomena described above belong to very different levels of reality and no attempt is being made, nor should it be, to reduce any one level of reality to another, the link between them is now being made, not by way of analogy, but by way of homology. That is to say, the principles of self-renewal and self-organisation now being recognised in nature and culture alike are not formally similar principles, but the same principles. . . . The challenge is not to treat educational systems, by way of analogy, as if they were dissipative structures, but to consider what difference it would make to the study and practice of educational administration in general, and of leadership in particular, if educational systems really are dissipative structures, characteristically self-renewing and self-organising (pp. 8-9).

Sungaila (1990) translates the butterfly effect into administrative language by suggesting that “the creative input of a single individual [(the leader)] can make a contribution to change in that organization. She combines the idea of the “nucleation mechanism”—that the leader will begin the change process with small changes in a limited region of the organization that will eventually “invade the whole space” (p. 13)—with Peters’ (1982) description of Kaizen (constant improvement). She further suggests that a “vector of vision” is required from the leader: This is the leader’s own vision [of the direction in which the organization should develop], not a rigid master plan or grand design, but a compelling vision” (p. 14). Like Burns (1978) and Alinsky (1946/1969; 1971), Sungaila emphasizes that the leader must deal in culture and politics in order to “influence people to make the choices that will create the new order of things” (p. 17). According to Sungaila, a science of school leadership can be created from the New Science of chaos,

forged from a synthesis of the natural and social sciences and based on an understanding of the school or school system as a dissipative structure.

Griffiths, Hart and Blair (1991) sound the first criticisms of research relating chaos theory to educational administration. They begin by identifying the five common characteristics of chaotic systems: nonlinearity, complex forms, recursive symmetries between scale levels, sensitivity to initial conditions, and feedback mechanisms. They then review the “evidence” in the field of education, which in 1991 consisted of Sungaila (1990) whom they found enthusiastic, but without supporting evidence; and Cziko (1989) who raised the issue of prediction, pointing out that “no clear predictions of exact scores on the posttest are possible using our current models” (p. 435). Griffiths, Hart and Blair point out that the idea of worrying about the big things and the little things will take care of themselves is not true in a nonlinear system: “attention should be paid to total systems as well as to small initial conditions” (p. 436). “Chaos theory suggests that all events deserve attention and monitoring; no growing effect should be ignored” (p. 440).

The next part of the article is a case study of a school district undergoing rapid change. The authors “attempt to understand and explain the events in [the case] using the central concepts of chaos systems theory described earlier” (p. 445). In their discussion section, they point out that their analysis is “post hoc.” However, all investigations of chaotic, nonlinear phenomena must be post hoc, since they cannot be predictive except in the short term. Their conclusion:

The case analysis we undertook . . . left us less than sanguine about [the potential of chaos theory] unless applicable precepts guide research design, data gathering, and analysis. Scholars should take care to avoid a tautology by looking for turbulence, strange attractors, and other social phenomenon



named after chaotic systems' concepts and finding them as a result of the imprecision of the instrumentation and measures available and the generality of the concepts when applied to social experiences (p. 448).

Despite serious concerns about the applicability of chaos theory to the study of education, the authors remain "hopeful" because "many of the concepts on which chaos is built hold intuitive and explanatory value for fundamental and important research issues in educational administration" (p. 450).

Newman, Wessinger, and Bobner (1993) also criticize some of the researchers in the behavioral sciences who have supported chaos theory "as a panacea for understanding human behavior" (p. 2). They review the features of chaos theory, pointing out its relevance and applications to research in human behavior. First they remind us, chaos theory relates to nonlinear systems, and "it tends to be different from traditional scientific theory in that it focuses on interrelationships rather than individual elements" (p. 3). A difficulty in human behavior studies in education is that "in describing human behavior, an extreme score may . . . become part of a pattern of behavior which may not be apparent until many data points are plotted" (p. 4). Another problem is that "human behavior is multidimensionally complex" (p. 4). The authors are concerned that "the philosophical implications of chaos theory have been misapplied in practical terms. If this practice continues, we may have a powerful technique that will lose credibility because of its misapplication" (p. 5). They conclude:

As professionals, we should be committed to supporting the investigation or [sic] our subject matter with the most appropriate scientific tools. Current research methods may oversimplify our complex content area. Chaos theory presents an approach that may be more appropriate in theoretical terms, yet its practical application is difficult. We have an obligation to our profession to investigate the potential applicability and usefulness of chaos theory for understanding human behavior (p. 5).

Other researchers, mostly working within the last ten years, and often basing their conceptual framework on Senge's (1990) work in *The Fifth Discipline*, have looked at the topics of *school change and reform, curriculum and planning*, and *educational leadership*. We will discuss the findings in each of these categories.

### School Change and Reform

We will define *school change* as the desire on the part of educators to create schools which will most effectively meet the educational and learning needs of their students in a changing world. The term *reform* is frequently used in that context, the implication being that reform is always needed. We will assume that when either of the terms *change* or *reform* is used, improvement in some aspect of the school or in student performance is implied.

Fullan's work *Change forces* (1994) has been definitive in identifying the failure of the school reform movement begun with prompting from the criticisms expressed by the United States National Commission on Excellence in Education report, *A nation at risk*, in 1983. Ted Sizer's school reform efforts, beginning with *Horace's compromise* in 1984 and continuing with *Horace's school* (1992) perhaps best represent the ideas of reform which have now been percolating or simmering for almost twenty years. Fullan's 1991 work with Stigelbauer, *The new meaning of educational change*, proposes a theoretical framework for understanding the change process.

In *Change forces* (1994), Fullan argues that school change is impossible because schools are conservative systems which inherently resist change. Neither legislation nor local reform efforts can be effective unless a new paradigm of change is employed, including these eight basic lessons of change:

1. you can't mandate or force change.
2. change is a journey, not a blueprint.
3. problems are our friends.
4. vision and strategic planning come later.
5. individualism and collectivism must have equal power.
6. neither centralization nor decentralization works by itself.
7. connection with the wider environment is critical for success.
8. every person is a change agent.

Wagner's *How schools change* (1994) draws similar conclusions. These principles can be directly connected and explained in terms of the new world view of quantum physics and chaos theory. Senge et al. (2000) suggest in *Schools that learn* that the answer to these lessons of change is to build a school culture in which change is a given.

Hansen (1994) takes a generic systems approach and elaborates its parts, claiming that such a model is useful in considering problems of educational reform and educational assessment.

Fleener (1995) based her paper on transforming schooling for the 21<sup>st</sup> century on the five-part systems model of Senge: personal mastery, mental models, the building of shared vision, team learning, and systems thinking. Her premise, similar to that of this dissertation, is that educational transformation is necessary for survival in an increasingly complex world. She sees schools' main purpose as providing students "with the ability to continue to learn and adapt to the flux or [sic] changing world society," (p. 14).

Howard Gardner's efforts towards school reform have centered on his theory of multiple intelligences, most recently re-configured in 1999. In emphasizing the various

dimensions of intelligence, his research and theory connect with the New Science concepts of complexity and systems thinking: one must never assume that a single measure of intelligence on any scale will adequately represent the complexity of a student's interactions with the world and with school materials.

Livingston, Bridges and Wylie (1998) use the metaphors of chaos theory in describing two quality schools where "shared vision" was clearly articulated and played a key role in helping the students to achieve.

Most recently, Hannay, Ross, and Erb (2000) have proved Fullan's change principles in considering the change process in a Canadian secondary school in which changes were imposed, top-down. In observing the process of change, the researchers found that "restructuring would require a reculturing of stakeholders." Change began to happen "when participants supported constantly evolving and emerging organizational values, involved stakeholders in making the decisions in a collaborative manner, and rethought the functions of the organizations more in terms of processes as opposed to isolated tasks." The concept of the "living organization" was helpful in supporting the idea of continual organizational learning.

### Curriculum and Planning

Several researchers and writers have considered applications of New Science to curriculum and planning. Perhaps first was Clark (1972), looking at the implications of Bertalanffy's systems theory in terms of educational curriculum at the college level.

MacPherson (1995) begins his article in the *Journal of Curriculum Studies* by criticizing the premise "that the universe is a deterministic and predictable place" (p. 263), and makes the prediction that the metaphors of chaos theory will be increasingly

important in the coming years, resulting in changes in educational research and in the way curriculum is studied. “[The new paradigm of chaos theory] will have major implications for educational research and the study of the curriculum” (p. 264). The social sciences are in need of new paradigms, MacPherson asserts, because educational research based on “studies of phenomena that have been stripped of the complexities of the real world” (p. 267) have not provided any useful applications for practitioners: “for the large-scale questions we face, educational research has been spectacularly unsuccessful at providing much beyond truisms as guidance to practitioners” (p. 267).

MacPherson (1995) uses the terms related to chaos theory as “metaphors,” describing the “strange attractors” in education: “some ways in which modes of communication and decision making, administrative style, employee behaviour and interpersonal relations tend to cohabit or mutually inhibit one another. . . .” (p. 271). By teaching administrators to recognize and work within these metaphorical frames, he suggests, we could increase their leadership effectiveness.

MacPherson suggests that his “strange attractors” answer these questions for a given school, creating a cluster of behaviors (or a myth, as he calls it) that has persisted in Western education:

1. What are schools for?
2. So what should the curriculum be like?
3. Who should design the curriculum?
4. Who should deliver it, and how should they be selected and prepared?
5. What are the mechanisms for compliance?
6. How can we tell whether or not anything is happening?

MacPherson lists eight “attractors” and briefly characterizes each one, starting with the Platonic attractor. Three and four—listed verbatim, below—will be easily recognized by educators. According to MacPherson, the attractors gain adherents and perhaps a loud, persuasive icon who characterizes the attractor; eventually the needs which are not being met by the attractor in favor at the moment may cause a new attractor to gain ascendancy and the old one to fall out of favor.

3. *The Scientific attractor*: Characterized in our time by the alphabet soup curricula and Bruner (1960) before his recantation. Schools are to nurture scientific talent and curricula should be designed by experts and delivered by journeymen who have been in-serviced as to how best to present the teacher-proof materials with which they are supplied.

4. *The Do-it-Yourself attractor*: Characterized by Dewey (1938). Learners build their own realities out of their own experiences, so the curriculum is best created on the spot and delivered by sophisticated teachers. If it all works, schools will produce confident and mature life long learners.

MacPherson’s attractors, he clarifies, are “legitimized more by ideology than by epistemology” (p. 277). But if we recognize the process by which attractors succeed one another, we could then study, and perhaps better direct the flow of the change process.

Goff (1998) looks at chaos theory as a framework for understanding the process of curriculum development. She also gives examples of collaborative leadership in helping to develop fitting curricula, calling upon “trust, patience, and a clear, socially constructed vision” (p. 38) as necessary prerequisites for change to take place. In her conclusion she further suggests a role that chaos theory can play in “reconcil[ing] the

distinction often made between the hard and soft sciences, providing firmer footing for an interdisciplinary curriculum more complex than the traditional and unsatisfying departmentalized curriculums of the sciences and the humanities.” (p. 40). Like MacPherson (1995), Goff (1998) sees chaos theory as more than a simple metaphor. It is for her, too, a paradigm shift, a whole new way of viewing the process of curriculum development:

As a response to changes in our postmodern society, I believe a model drawn from chaos theory can be more than just another useful model for curriculum—it models a new process that includes both the development and implementation of curriculum, both individual and organizational behavior, both unique interpretations and common understandings. (p. 41).

All of the sources cited share this appreciation for a paradigm shift which requires a new way of seeing the world.

Cutright (1999) applies chaos theory to strategic planning of institutions of higher learning, based on case studies of Blue Ridge Community College (Virginia), Carson-Newman College (Tennessee), the University of Calgary (Alberta), and Red Deer College (Alberta). His 10 propositions for planning echo Fullan (1994) and Senge (1990).

#### Leadership in Education (Administration)

A few dissertations have focused on either systems theory or chaos theory as it relates to leadership in education.

Akbaba (1999) connects the rapidly changing situations facing elementary school principals in urban settings to chaos theory, and proposes that chaos theory be part of principal preparation to help them cope with unanticipated situations.

Fiene (1997) looks directly at the relationship between New Science metaphors and educational leadership. In the introduction to her dissertation, she bemoans the lack of progress in educational research because we have not been able to uncover “a set of ready-made effective techniques or programs that is generically transferable from one school to another, or that is even able to guarantee success for each student” (p. 5). She reviews the key terms for chaos study: bifurcations, butterfly effect, dissipative structures, entropy, fractals, limit cycles, nonlinearity, period doublings, quasi-periodicity, self-similarity, and strange attractors. She then looks at the conceptual base of the metaphors of chaos theory, connecting them to the educational leader’s context. She submitted her “metaphorical exemplars” to a panel of ten practitioners (Leadership Academy participants, all of whom were educational administrators from rural, suburban, urban, public and private K-12 schools from across Missouri) and five experts who had published or presented at least one article relating to chaos theory. The panel reviewed her metaphorical exemplars of chaos theory “for validation of conceptual consistency [sic] and applicable reality to the world of practice.” Her findings suggested that chaos theory can “lead to explanation of educational phenomena,” and that the examples she generated “are consistent with regard to fit with the elements of chaos theory.” She suggests that more metaphors, models, and theoretical frameworks of chaos theory need to be developed. I would suggest that Senge’s (1990) work in business organizations may allow us to skip some of this development, if we are willing to accept the similarity of business organizations to educational organizations.

Blair (1993) lays out the six central concepts of chaos theory: the butterfly effect, onset of turbulence, dissipative structures, random shocks, strange attractors, and



recursive symmetries and feedback mechanisms. She relates this theory to the daily experiences of five principals, using so-called “butterfly stories”: anecdotal narratives which reflect the central concepts identified above. In her reviewing administrators’ comments on the job (as opposed to theoretical concepts of administration taught in classes), Blair suggests that “unpredictability of the administrator’s day and its requirements” and “the surprising and unexpected responses elicited from others to ordinary requests or actions by the administrator” are the greatest sources of stress on the job. Chaos theory implies that leaders should monitor all events, since initial small events can be magnified greatly by the butterfly effect. *Onset of turbulence* can be “difficult to determine because it requires careful *ex post facto* examination” (p. 583). Administrators can be alert to *strange attractors* as “the system shifts course and seems to re-emerge attracted to recurrent issues” (p. 583). Blair suggests that *recursive symmetry* in education is represented by the system’s rules and goals. Finally, she suggests that test scores can be fed back into the educational system as part of the *feedback mechanism*.

Blair (1993) next presents scenarios developed from the experiences of five principals at varying levels of experience, relating to two of the chaos terms, the *butterfly effect* and onset of *turbulence*. In the data analysis, Blair asks, “Can the use of Chaos Theory enhance the effectiveness of a new and experienced administrator and improve his/her performance beyond that normally expected by the years of experience?” (p. 589). The larger concern addressed in her conclusion is “whether the participants would be able to generate meaning from a knowledge of Chaos Theory. . . relate this meaning to educational practice, . . . [and] effect practice in relationship to their knowledge” (p. 593).

Her conclusion is that for the five administrators in the study, the answer is yes.

Furthermore, the stories suggested these “precepts” for administrators, derived from chaos theory:

- Thorough investigation of emerging situations is needed.
- In almost every situation, snap decisions are to be avoided.
- A precise and slow process of decision making is required as well as the ability to resist pressure to provide knee-jerk reactions.
- Small things can equal big consequences.
- Therefore, contrary to the “myths” that administrators have heard, seemingly small matters ARE important.
- Every decision and action must have the proper amount of attention to ensure its quality.
- Make no assumptions and judgments about people or events until one’s relevant research has been done.
- Look for the imbedded order of each chaotic situation. Knowledge of deep structures of order serve to offer perspective to accidentally triggered chaotic events. (p. 595).

These items will be helpful in building a profile of a “New Sciences” administrator.

Hunter (1996) gives a thoughtful, critical look at the research in education using chaos theory, suggesting that “a leap of faith is required for those who transpose [chaos theory’s] precepts to educational endeavor” (p. 10), and that it will not be very useful for “taming turbulence in social and educational regimes” (p. 10). In his discussion of chaos theory, Hunter explains the two schools of thought in the field: the first, which sees chaos as the precursor and partner of order, is best represented by Priogogine and Stenger’s (1984) *Order out of chaos*. The second focuses on systems that remain chaotic, where the focus can be on the strange attractors, and the “organized structures that emerge from chaos” (p. 13). After a clear review of the principles of chaos theory and its applications in science, Hunter turns to the key question in social and educational systems:

whether human organizations and beings behave in similar ways to the inanimate world, and to those evident in the biological world. Do the behavior of turbulent gases and the flow of a cascading waterfall correspond to human group behavior? (p. 19).

While researchers in a variety of scientific fields have documented chaotic effects and developed the mathematical descriptions of their systems,

it has been virtually impossible to document and confirm chaos theory's propositions in social systems, largely because of the huge scales of investigation and lack of precise and appropriate methods to quantify human behavior. As a result, it remains difficult to ascertain what chaotics may offer the educational administrator (p. 20).

Hunter's first criticism is that as chaos theory has been applied to management, "chaotics has become not the systematic study of nonprobability in educational systems, but rather an initiative to understand how managers can administer systems in chaos" (p. 21). "Those who adapt chaos theory to educational systems usually proceed by analogy and by metaphor rather than by testing hypotheses through induction" (p. 21). Hunter asserts that without predictive power, chaos theory offers us nothing more than any other management theory (p. 22). A second problem is that "we lack empirical tests of the decision-rules which prevail in large social systems" (p. 22).

"Proving" that chaos theory applies to human behavior will eventually depend on being able to quantify and interpret behavior on a global scale; the complex social dynamic will have to be mapped across a variety of the social science disciplines—including economics, sociology and political science—to determine the exact nature of underlying structures in social behavior (pp. 24-25).

At the present time, Hunter points out, we have only begun to develop adequate systems to monitor human behavior (p. 25).

Despite these considerable objections, Hunter is not ready to dismiss the value of chaos theory to administrators. Instead he suggests "chaos theory may have its greatest

impact in terms of how we view an organization, and by extension how one proceeds with planning” (p. 27).

In its transposition to management thinking, the colorful anecdote, the case study, and the packaged promotion in best sellers by Senge (1990) or Peters (1982) are the basis of some current applications of chaos theory, not differential equations which account for the quantitative movement of objects in system space. . . Chaos theory may have left the physicist’s laboratory in the late 1980s, became the object of fascination by graduate students in pursuit of dissertational novelty in the early 1990s, and is now percolating onto the best seller shelves—but it has left its scientific moorings behind. The theory has become unbound, explored metaphorically in postmodern analyses of literature and equated with critical theory (pp. 28-29).

Hunter (1996) also reviews Griffiths, Hart and Blair (1991), faulting their conclusions because they used case analyses to examine the value of the theory. Despite the fact that they were not able to report very much success in their methodology, they still “conclude argumentum ad ignorantiam that ‘many of the concepts on which chaos is built hold intuitive and explanatory value’ (p. 450), while admitting that enthusiasm did not translate easily into meaningful research” (p. 30).

Hunter (1996) then reflects on the role of planning, and the administrator’s part in developing plans, warning administrators not to decide that planning is useless even though we may know from the study of chaos that the future is uncertain. Planners need to take the “multiplicity of variables” and the “influx of turbulence” (p. 30) into account when planning; they also need to see the future not “as an extension of contemporary circumstances” but rather “as being shaped by the creative intellect. Statistical projections fail to recognize the presence of free will. The external and internal environments may be strong influences in shaping the future, but so are dreams, values, and ambitions” (p. 30). This view of leadership is exactly what Senge (1990) means by

Vision. In a systems perspective, one must understand the parts of the system and how they will work towards or against the goals of the leader, but without vision and subsequent commitment to that vision, the goals simply evaporate.

But Hunter (1996) sees a value in chaos theory in keeping strategic planners from using “simplistic, linear checklists and lock-step approaches” (p. 30). He suggests instead that planners do more “scenario” planning, in which hypothetical situations are discussed in order to prepare the organization for all the possible outcomes in response to planning (p. 31). Hunter says:

Perhaps the most pertinent implication of chaos theory for strategic thinking is what it says about the nature of effective plans. The ideal outcome of planning is planning, not the plan. Rather than focusing on the product-blueprints or compendious and detailed documents, to be sequentially implemented over extended time frames—chaos theory implies the process is more important (p. 31).

So after criticizing others for “the tenuous assumption that the theory applies to social and educational endeavor” (p. 31), Hunter goes on to follow out that assumption with recommendations: “Managers should pay systematic attention to the ragged edges of disorder which prevail at the edges of and within the system of which they are in charge” (p. 31). “Management strategies should have short temporal horizons and be relatively imprecise” (p. 31).

Hunter concludes that the value of chaotics is to serve “as an imaginative foil to the long term, cyclic planning [sic] systems which predominate in educational administration” (p. 32), but responds dismissively to its overall usefulness: “Although chaotics may resonate with those prone to latch onto the latest management fad, the theory will likely remain at the very margins of administrative thinking in education” (p. 32).

Wallace, Sweatt, and Acker-Hocevar (1999) review the past models of administrative leadership and suggest that none of them is adequate to cope with the rapidly changing world in which we live. They suggest that a new framework needs to be based in new leadership approaches, open-systems theory, and learning organizations, so that administrators can better cope with a rapidly changing world.

Sullivan (1999) proposes chaos theory as a way for leaders to implement change through better understanding of an organization's dynamic systems. Basing his understanding of chaos theory on Briggs and Peat (1990) and Gleick (1988), among others, Sullivan proposes that we must understand chaos within the change process as a necessary part of the disorder through which an organization must pass if it is to "evolve" into a "new order" (p. 408). Thus, leaders in educational organizations must understand this process of passing through chaos as something to be "encouraged and managed" (p. 408). Sullivan cites Sungaila's (1990) article as focusing on the use of systems theory and organization theory in educational administration.

Sullivan (1999) suggests that educational leaders, understanding the nature of chaotic systems, need to "develop a creative, perhaps artistic, recurrent approach to planning" (p. 414), rather than to abandon planning at all because of the impossibility of prediction. In recognizing that policy implementation will be a gradual process, involving different people and groups within the organization at different intensities and different times, educational leaders can also recognize ways in which to act opportunely in order to "[seek] influencing variables and points of sensitivity that may combine alignment of purpose for the administration of the organisation" (p. 417).

Sullivan (1999) suggests as well that educational leaders may use computerized modeling to document system evolution over a period of time in order “to learn about . . . critical points of sensitivity and . . . robust points of homeostasis in relation to individuals, groups, and current organisational issues” (p. 417). “The art of creative suspension is the art of intuitively feeling the simple and small changes within the system of education and applying gentle creative action in the appropriate places” (p. 421). Sullivan also stresses collaborative groups as a way to implement strategic plans, understanding that such groups form “a network of self-managing teams who work on interconnected projects. Recognizing this method of implementing change within an educational organization, Sullivan says, provides a way to insure that school organizations will continue to develop in order to meet society’s changing needs (p. 421).

Sullivan points out that to expect an organizational system to “remain the same” is to wish for or get the “death” of the system. Instead, one must “positively ride the crest [of the chaotic waves of change], making small adjustments on the way and eventually achieving a renewed and improved system of education” (p. 422).

### Business Models of Organizations in Education

#### Critics of Chaos in Education

Many educational theorists and researchers, as just demonstrated, have embraced both New Science concepts and the organizational models borrowed or adapted from business. Some researchers have questioned the value of chaos theory’s applications in education, either because of difficulties in transferring a scientific model to a social science (Benson & Hunter, 1992-1993; Hunter, 1996), or because of conceptual

difficulties or misunderstandings of chaos theory (Newman, Wessinger & Bobner, 1993; Hunter, 1996; Griffiths, Hart & Blair, 1991).

### The Role of Leadership

Carole Havens, in her 1997 doctoral dissertation, *The Relationship between classical and new science paradigms and organizational and educational leadership*, has made an excellent beginning on establishing the connection between Newtonian world views (classical) and new science world views. She reviews scientific management, human relations, systems theory, and transformational leadership theory in connection with the development of educational leadership. It is clear from her review that schools can reasonably be seen as organizational systems, and that “the development of educational organizations, management, and leadership reflect and parallel that of organizational management and leadership theory in general” (p. 89).

Havens (1997) also believes that school leaders need to be transformational leaders, as Burns (1978) has defined them. It is only when this kind of leadership is in place that lasting change and improvement can take place. Havens points out the necessity for inter-dependence of all parts of an organization in order to implement change:

Neither governments, central offices, nor principals can mandate change which is transformational and successful. School change begins with individuals who understand schools, teachers, *and* principals, and spreads in iterative and inclusive ways throughout the community (p. 113).

The applied research part of Havens' study was a single site case study based on survey data and focused interviews of “teacher leaders” at an elementary school.

In discussing the role of leadership in education, Laszlo's systems theory can be linked with Burns' concept of *transformational leadership* (1978), as Havens (1997)



does. Burns' work proposes a theory of historical/political leadership, which can also be integrated with Senge's (1990) and Wheatley's (1992) concepts of systems thinking and leadership in business organizations. Burns' emphasis on higher-level moral development and the interaction of leaders and followers for their mutual benefit is especially appropriate for the field of education. Burns' work anticipates Senge's and Wheatley's, and even incorporates metaphors which are typically New Science, such as "web" and "flow."

Leadership in business organizations has been the topic of hundreds of books in the last dozen years. This study focuses mainly on Senge (1990) and Wheatley(1992). Their work emphasizes moral leadership: they see leaders and organizations as having the essential purpose of developing the potentialities of the people within the organization. That perspective, essentially a moral position, is key in educational organizations. The implication, in both Senge and Wheatley, is that development of an organization's members will lead to the organization becoming a "learning organization" to use Senge's term. Such business organizations, he claims, will continue to show profitability in good times and bad because they have "learned" to make the best use of the perspectives of all the people in the organization, thus maintaining a business "edge." Barnett and Tichy (2000) have defined *leadership edge* as following from the leader's commitment to "[act] on one's deeply held ideas and values," (p. 21). It is one of the four key qualities they identify as essential for CEO leadership.

Similarly, school organizations which maintain moral leadership at their core can truly be "learning organizations" to use Senge's term. The possibilities for change come from the flow of colliding ideas among diverse groups: it's about interconnectedness.

From principals to teachers to parents, change spreads in iterative and inclusive ways; and thus these organizations are able to change as circumstances change. Educators are concerned with essential values and morals—the strange attractors—going beyond the “bottom line” of profit and loss in the business world.

The old paradigm required a predictive framework; the new paradigm is more evolutionary. Adding Senge’s (1990) *Fifth discipline* approach to qualities of leaders and of learning organizations to the suggestions of the early researchers of quantum physics and chaos theory in education can help to develop the new worldview which will shift the traditional concept of school change and school leadership. More applications will follow as more and more educators come to a new way of seeing the world. They will look at their students, their principals, and their schools with new eyes.

## CHAPTER III

### FROM NEW SCIENCE TO ORGANIZATIONS TO SCHOOLS

RESEARCH QUESTIONS: 1. How do the scientific understandings derived from the New Sciences provide valid understandings of the real world?  
2. How can New Science understandings serve as meaningful models for understanding human organizations such as schools—how they function and how they change?

“To most people, the world of physics seems remote. Its abstract mathematical formulae and complex experimental results seem to bear no relation to the concerns of everyday life, to the passions we feel, the kinds of decisions that we must make from moment to moment, to the nature of our social institutions. Yet we human beings are physical creatures. The dynamics of both our bodies and our minds emerge from the same laws and forces that move the sun and the moon or that bind atoms together.” (Zohar & Marshall, 1994, p. 12).

New Science concepts have infused organizational thinking, from the systems thinking of Laszlo (1972, *Systems view*) through Senge (1990), Wheatley (1992), and others. This chapter provides an overview of the key ideas which have shaped twentieth century physics (quantum mechanics) and the mathematics of nonlinear dynamical systems (chaos theory), in enough detail so that the concepts can be well understood, and with enough historical context so that the reader can move from the typical non-scientist Western background to the new way of thinking which must accompany an acceptance of the scientific validity of these ideas. The goal will be to make the basic concepts clear so that the organizational constructs related to New Science concepts can be understood. As each concept is introduced, connections will be included from Senge (1990), Wheatley (1992/1999) and others to delineate how these scientific concepts have been interpreted

in terms of business organizations. At the end, the key organizational concepts will be recapitulated and a school model will be built on the organizational framework.

For a more detailed, comprehensive understanding of the puzzles of quantum science and chaos theory, it is best to consult one of the books written by scientists for the non-scientist. For quantum physics, good sources are Wolf (1989), Lindley (1996) and Wallace (1996); for chaos theory, Briggs and Peat (1989), Smith (1998), and that beautifully written and accessible text by Gleick (1987).

#### Quantum Concepts: Complementarity, Uncertainty, Fields, and Wholeness

Historically, the scientific foundation of quantum physics preceded chaos theory by several decades. Thus we'll begin with these quantum ideas: complementarity, the uncertainty principle, the concept of fields, and the idea of wholeness or oneness.

#### Complementarity

The first and most challenging concept for Western minds is the principle of complementarity, also known as wave-particle duality. Western notions of reality since the time of Descartes have made it difficult for Western thinkers to understand the dual nature of packets of energy, and their potential to be observed as either waves or particles. Newton's ideas of classical physics have influenced even twentieth century thinkers to believe that the world is a great machine that can be understood in terms of forces and counter-forces, and that any action is the sum of its parts.

The principle of complementarity suggests something else. It developed as a result of the study of subatomic particles and waves, and it led to this understanding of the nature of matter: matter can show up as *particles*—specific points in space—OR it can show up as *waves*—energy dispersed over a finite area. The *wave packet* contains

the *potential* for both forms, *particles* and *waves*. A Newtonian physicist or a Cartesian philosopher might say, “Well, it must be one or the other! Which is it? What is the ultimate nature of this *matter*?” And the answer would be, “It is both. The wave packet contains the potential for both particles and waves. That is the principle of complementarity.” To insist that it must be one or the other is to make a false distinction which denies the totality of the wave packet.

Wheatley (1996) points out how a reliance on Newtonian thinking has fortified the resistance to the idea of complementarity: “Until recently we really believed that we could study the parts, no matter how many of them there were, to arrive at a knowledge of the whole. We have reduced and described and separated things into cause and effect, and drawn the world in lines and boxes” (p. 29). In Eastern thought, by contrast, there has been a willingness to embrace the contradiction or paradox of opposites, as illustrated by the Chinese symbol of *t'ai-chi*, which represents the opposites of *yin* and *yang* (male and female aspects of being).

#### The Uncertainty Principle

If the physicist studying subatomic particles sets up an experiment to determine the position or location of a particle, location can be determined, but the momentum (or speed) of the particle will remain uncertain. The uncertainty principle is a “precise mathematical form of the relation between the uncertainties of position and momentum of a particle” (Capra, 1985, p. 158). If the experimenter tries to determine the momentum of a particle, the location becomes hazy. The problem is not with the measurement strategies or limitations, but with the nature of the phenomenon being studied: one can know location (particle) OR momentum (wave), but not both at once. At one point in

time they are both wave and particle in potential state. In the condition of measurement, it becomes one or the other.

Capra (1985) explains how physicist Niels Bohr understood the notion of complementarity:

He considered the particle picture and the wave picture as two complementary descriptions of the same reality, each of them being only partly correct and having a limited range of application. Each picture is needed to give a full description of the atomic reality, and both are to be applied within the limitations given by the uncertainty principle (p. 160).

#### The Role of the Scientist/Observer

Furthermore, the role of the scientist or observer influences the result of experiments in quantum physics, to the extent that the experimenter's determination to analyze momentum, for example, will produce results in terms of momentum. The observer is thus an integral part of the "object" being observed. In quantum physics, therefore, the idea of scientific objectivity loses meaning, and it is equally meaningless to suppose that the scientist will have no influence on the experiment. Quite the opposite is true: she or he will influence the results in the most basic way. Capra (1985) quotes physicist John Wheeler, who emphasizes this point:

Nothing is more important about the quantum principle than this, that it destroys the concept of the world as "sitting out there", with the observer safely separated from it by a 20 centimeter slab of plate glass. Even to observe so miniscule an object as an electron, he must shatter the glass. He must reach in. He must install his chosen measuring equipment. It is up to him to decide whether he shall measure position or momentum. To install the equipment to measure the one prevents and excludes his installing the equipment to measure the other. Moreover, the measurement changes the state of the electron. The universe will never afterwards be the same. To describe what has happened, one has to cross out that old word 'observer' and put in its place the new word 'participator'. In some strange sense the universe is a participatory universe' (p. 141).

Even as the scientist participates in the universe, changing or creating reality by what she selectively experiments upon, the bits of matter—large or small—which she observes continue to interact and influence each other in a connected way.

#### Fields as Co-created by Actors/Participants

The connections can be explained by the concept of fields, first introduced by two nineteenth century scientists, Michael Faraday and Clerk Maxwell. “They were the first to go beyond Newtonian physics” (Capra, 1985, p. 59), developing a complete theory of electromagnetism; but their theory of fields was to grow beyond electromagnetism to the “quantum field theories” which “describe the force fields of subatomic particles” (Capra, 1985, p. 270), and to gravitational fields. Scientists’ understanding of fields has expanded from the electromagnetic fields of Faraday and Maxwell. “Space everywhere is now thought to be filled with fields, invisible, non-material influences that are the basic substance of the universe. We cannot see these fields, but we do observe their effects” (Wheatley, 1999, p. 50).

It is in the consideration of gravitational fields that Einstein’s theory of relativity comes into play, as Capra (1985) explains. Matter and empty space are not separable. Where large bodies of matter exist, a gravitational field will be manifested, which will curve the space around that body.

We must not think, however, that the field fills the space and “curves” it. The two cannot be distinguished; the field *is* the curved space! . . . Matter and space are thus seen to be inseparable and interdependent parts of a single whole (p. 208).

Each object thus creates a field that extends infinitely far.

The quantum world emphasizes relationship of particles:

the two electrons are linked by non-visible connections; they are, in fact, an indivisible whole that cannot be broken into parts, even when separated by space. When an attempt is made to measure them as discrete parts, scientists get stymied by the fact of their invisible connectedness (Wheatley, 1999, p. 42).

Wheatley suggests that organizations need to be aware of process in relationships, and focus on supporting individual development, but within the context of the organization, rather than as individuals: “The quantum world has demolished the concept that we are unconnected individuals. More and more relationships are in store for us, out there in the vast web of life” (p. 39). But if we truly take a systems view, we have to acknowledge the inadequacy of Senge’s causal loops, which seem to show things in a strict causal sequence, even if circular. In fact, as Wheatley (1999) points out, “we can’t possibly see all the connections that are truly there. When we take a step or make a decision, we are tugging at webs of relationships that are seldom visible but always present” (p. 42). The image of web representing interconnectedness resonates powerfully with New Science thinkers, and has become a theme of late twentieth century biologists. See, for example, Capra’s *Web of life* (1996).

Relational aspects of society and consciousness are emphasized in Zohar and Marshall’s *Quantum society* (1994):

The sharp, mechanist boundary between self and other gives way to a more fluid overlapping and entwining of constantly shifting dynamic patterns. . . . The quantum other is both (an aspect of) myself and my opportunity . . . to grow and to evolve, my opportunity to realize my own potential self. Seeing the other as such takes us well beyond an attitude of tolerance. *The quantum other is my necessity* (p. 193).

Understanding social relationships in this way is based on the concept of evolution towards increasing complexity. The places where people of many cultures meet—such



as schools—become the places for interchanges within “the common pool of our evolutionary potential” (p. 195).

#### Wholeness in Quantum Thinking

The concept of wholeness, oneness, of the entire system is a key quantum idea that follows from the concepts we have just touched upon—complementarity, uncertainty, and fields—as they relate to particle physics. But even among physicists, there has not been universal agreement on how these principles operate in the universe. The best-known disagreement is represented by the thought experiment developed in 1935 by Einstein and his two collaborators Podolsky and Rosen, known as the Einstein-Podolsky-Rosen (EPR) experiment. (For a complete discussion of this experiment and its significance, see Capra, 1985, p.311-313; Wolf, 1989, p. 153-163+; Lindley, 1996, pp. 91-96.)

The EPR experiment began as a thought experiment. Thought experiments are heuristics designed to examine the properties of proposed theories. In quantum physics, perhaps the most famous thought experiment is Schrodinger’s cat (see *The Chronic poor health of Schrodinger’s cat*, Lindley (1996, p. 72-79). Hayles (1990) has argued that thought experiments serve the same role in scientific theory and understanding as metaphors do in literature: heuristic fictions show similarities between the fiction and the theory while simultaneously pointing out areas of difference. “The loose bagginess of the fit between heuristic fiction and the theory is important, for it can open passages to new interpretations” (p. 33). Often, such puzzles or paradoxes remain unresolved for years. Thirty years after Einstein, et al., proposed the EPR experiment<sup>1</sup>, John Bell developed a theorem which supported Bohr’s position established to counter EPR—that two

connected electrons, even if separated by a great distance, “are linked by instantaneous, nonlocal connections” (Capra, 1985, p. 313). Almost 50 years had passed before Alain Aspect—in 1982—was able to provide unequivocal experimental data which tested Bell’s theorem (Lindley, 1996, p. 139-141), finding support for Bohr’s view that “the universe is fundamentally interconnected, interdependent, and inseparable” (Capra, 1985, p. 313).

Wheatley (1999) emphasizes that concept of inseparable relationship: she explains that particles pass through various stages in their interactions with energy sources. Even though the particles are named (“neutrons, electrons, and other particles”), they are part of “a network of interactions” (p. 34). Wheatley focuses early on this emphasis in the *New Sciences* on understanding systems as whole systems, and bringing attention to bear on “*relationships within those networks* [author’s emphasis]” (p. 10). Thus it is no longer relevant to name the parts; it is much more interesting in a quantum view to investigate the probabilities of the relationships among those parts. “Quantum theory has thus demolished the classical concepts of solid objects and of strictly deterministic laws of nature. At the subatomic level, the solid material objects of classical physics dissolve into wave-like patterns of probabilities, and these patterns, ultimately, do not represent probabilities of things, but rather probabilities of interconnections.” (Capra, 1983, p. 68).

#### Quantum Ideas in Organizations

Quantum ideas inform and infuse the concepts of organization as presented in Senge (1990) and Wheatley’s (1992/1999) works. These two works bridge the gap between Newtonian thinkers who divide things into parts and try to understand the whole

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<sup>1</sup> Wolf (1989) notes that Bell’s paper was not published until 1966, although Bell wrote it in 1964 (p. 202).

from the sum of those parts, and the New Science thinkers who must take a more holistic view of the world and of all the things which make it up.

### Systems Thinking (Senge, 1990)

The key for Senge (1990) is *systems thinking*. He posits five qualities of leadership for organizations (personal mastery, mental models, shared vision, team learning, and systems thinking), but the fifth discipline, systems thinking, is “the cornerstone of the learning organization” (title of Part II), and the quantum notion of “our [own] actions creat[ing] our reality” is introduced as the title of Part I. Thus the key quantum concept of oneness/wholeness (derived from the Principle of Complementarity and the Uncertainty principle, expressed in the notion of fields) is the central point of Senge’s new way of looking at business organizations. His audience in 1990 (and probably his audience today) is composed of Newtonian thinkers. Before he can get them to shift perspective (as he attempts to do in Chapter 5, “A Shift of Mind”) he must convince them of the value of this new way of thinking.

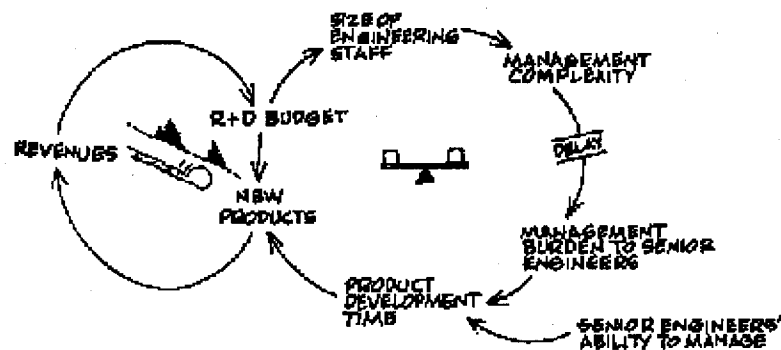
The causal loop diagrams with which he illustrates his text focus on cause and effect in a Newtonian way. Most Newtonian thinkers are more likely to think in straight lines and arrows; the causal loops in Senge’s illustrations of systems’ movements (see Figure 3.1 for an example) are a new concept for straight-line thinkers, but the diagrams are still limited in trying to express the totality of a reality where waves intersect and influence each other; no diagram can adequately illustrate the complex relationships which exist among parts of a system. For example, Senge (1990) describes the action in the following diagram this way:

A high-tech organization grows rapidly because of its ability to introduce new products. As new products grow, revenues grow, the R & D budget grows, and the engineering and research staff grows. Eventually, this burgeoning technical staff becomes increasingly complex and difficult to manage. The management burden often falls on senior engineers, who in turn have less time to spend on engineering. Diverting the most experienced engineers from engineering to management results in longer product development times, which slow down the introduction of new products (p. 97).

Figure 3.1

Causal Loop Diagram from Senge (1990), p. 97.

Used with permission of the author.



The complexity of those interactions in Figure 3.1 above is not adequately represented by those simplified causal loops. The school diagram presented in Senge, et al. (2000), developed ten years after *The fifth discipline* was first published, gives a better representation of the complexities of interactions. (See Appendix, Figure 3: Systems Diagram of School, Influences from the world at large.)

But though a complete understanding of Senge's (1990) work may require a paradigm shift, *The fifth discipline* is nevertheless an intensely practical manual of leadership qualities and practices designed to create business organizations which can survive, change, and grow. The implication is that these organizations and their leaders will have the competitive edge they need to survive and grow profitably in rapid

changing contexts. Senge has the documentation of the Fortune 500 business leaders who have bought in to the *Fifth discipline* framework and contributed the insights of their leadership and their company's re-structuring for the twenty-first century. Their insights and experiences are further detailed in Senge et al (1999), *The dance of change*.

Wheatley (1992) Uses New Science as a Metaphor for Understanding Organizations

Next Wheatley's (1992) attempts to understand organizations in quantum terms will be outlined; then the mathematical concept of chaos theory will be examined for its contributions to the organizational model. Finally, an examination of other writers' contributions to organizational thinking will be outlined. These organizational understandings can be applied specifically to schools.

Wheatley (1992) sets out with a slightly different purpose from Senge's (1990) building of learning organizations: she wants to use the concepts of New Science as metaphors to help to understand the key issues in leading organization: control vs. chaos; prediction vs. freedom; planning vs. participation; and communication overall (Preface, p. xiii). Wheatley quotes physicist Frank Oppenheimer in defending her use of New Science metaphors:

'If one has a new way of thinking, why not apply it wherever one's thought leads to? It is certainly entertaining to let oneself do so, but it is also often very illuminating and capable of leading to new and deep insights' (1999, p. 15).

One premise of this dissertation is that the new and deep insights offer more than entertainment in the field of education: they can provide a new way of viewing, understanding, and participating in the world in which we live, work, and lead.

## From Quantum Society to Quantum Organizations

Zohar and Marshall (1994) go beyond metaphor in *The Quantum society: Mind, physics and the new social vision*, suggesting that “quantum society” is a metaphorical model, but that the newest brain research suggests that there may be a genuine physics of society, that is part of the physics of the human brain and of human consciousness (p. 35).

Wheatley points out, and others (Havens, 1997; Sergiovanni, 1996) support that analysis, that the Newtonian model of science contributed to the Scientific model of management, in which hierarchy is all-important, and workers are seen as “replaceable cogs in the machinery of production” (1999, p.14). In the Newtonian worldview, Wheatley says,

. . . we’ve held on to an intense belief in cause and effect. We’ve raised planning to the highest of priestcrafts and imbued numbers with absolute power. We look to numbers to describe our economic health, our productivity, our physical well-being. . . . This reduction into parts and the proliferation of separations has characterized not just organizations, but everything in the Western world during the past three hundred years (pp. 28-29).

In addition, she points out, the ideal of scientific “objectivity” led to a sense of isolation and loneliness (p. 32). Quantum mechanics, on the other hand, suggests quite a different view for our organizations.

“Quantum imagery,” Wheatley (1999, p. 33) suggests, “challenges so many of our basic assumptions, including our understanding of relationships, connectedness, prediction, and control.” Quantum thinking is always probabilistic, with no complete prediction or control. The network of often invisible connections that exists among

members of an organization is the field on which organizational leaders make decisions and establish control. How do we see this organization differently in quantum terms?

Wheatley (1999) cites organizational theorist Karl Weick as having the view that “there is no objective reality; the environment we experience does not exist ‘out there.’ It is co-created through our acts of observation, what we choose to notice and worry about”(p. 37). This is the role of the participatory observer in the act of observing a reality that is changed by the process of observation. In terms of organizations, as Weick suggests, there is no longer much point in arguing about who is right and who is wrong; instead it will help the organization “to focus our concerns on issues of effectiveness, on reflective questions of what happened, and what actions might have served us better” (Wheatley, 1999, p. 37). Weick suggests that planning strategies “should be ‘just-in-time . . . , supported by more investment in general knowledge, a large skill repertoire, the ability to do a quick study, trust in intuitions, and sophistication in cutting losses’” (as quoted in Wheatley, 1999, p. 38).

A quantum understanding of an organization must thus lead to a very different way of considering strategic planning. Long-term advance studies and projections become less valuable, and perhaps not cost-efficient, because while the studies are being done, the situation changes. With a new knowledge of how the world works, we must, indeed, seek information about the current state of the organization in order to make strategic plans. As we seek that information, we need to be involving people from all parts of the organization in a meaningful way. And the process of making the plan may be more important than the plan itself, for in the process of planning together, the organization solidifies its future vision, which may establish the direction(s) in which the

organization will grow. Wheatley suggests that “the environment and our future remain uncreated until we engage with the present. We must interact with the world in order to see what we might create. Through engagement in the moment, we evoke our futures” (1999, p. 38). Zohar and Marshall (1994) echo that concept of the relationship which creates something greater than the sum of their parts:

If consciousness is an open, self-organizing system, it literally depends for its continued existence upon a constant input of relationship. In quantum terms, we are our relationships. We are relational wholes, some of whose qualities only come into existence when our being overlaps with that of others (p. 211).

The dance of co-creation is “diminished by the absence of those who are excluded” (p. 213), so it is important to be inclusive, welcoming diversity of people and opinions, and encouraging divergence from groupthink.

Senge (1990) answers the question, “What do we want to create as organizations?” with the concept of *vision*. Shared Vision is one of the Five Disciplines. Shared visions are “pictures that people throughout an organization carry. They create a sense of commonality that permeates the organization and gives coherence to diverse activities” (p. 206). Priesmeyer (1992) also offers *visioning* as a key process in managing organizations: “Visioning is synonymous with discernment, foresight, insight, imagination, and dreaming. It is the process of defining the future. . . . The ability to know the future greatly increases when we vision it” (p. 177).

Wheatley suggests that we see this web of interconnecting relationship—the connections we make with our co-workers as we envision and co-create the future—as an “organizational field” (pp. 52-55) of “interpenetrating influences and invisible forces that connect” (p. 52) and she suggests organizational vision as a way to create alignment in



organizations so that we can create a field that will “shine with coherence”(p. 55) and help to eliminate “some of the waste of organizational life” (p. 56).

What do the ideas of chaos theory add to our concept of the quantum world? First, the mathematics of chaos theory apply to nonlinear systems—in other words, to highly complex systems which are affected by multiple variables in indeterminable ways.

#### The Butterfly Effect: Sensitive Dependence on Initial Conditions

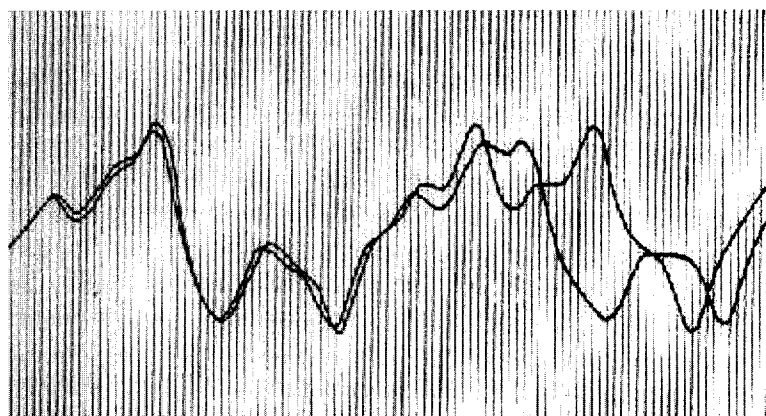
The story is told in Gleick (1987) and many other sources of Edward Lorenz’s discovery of the butterfly effect in 1961. He had set his computer to repeat calculations of nonlinear equations with six variables known to affect weather patterns, as he worked on developing computer programs to assist in weather prediction. To save time, he reset the computer to begin again half way through, entering .506 as the solution instead of .506127. When he returned from lunch, he was amazed to find the incredible divergence of the predicted weather patterns in the second run. Just an initial variation as small as .000127 had created a completely new and unexpected pattern in very short order. (See Figure 3.2, from Gleick, 1987, p. 17. Used with permission.). This *sensitive dependence on initial conditions* is known as the butterfly effect because an effect as small as the flutter of a butterfly’s wing in Beijing could ultimately result in a tornado in Omaha.

For Lorenz the meteorologist, sensitive dependence on initial conditions meant that long-term weather prediction was impossible. The problem of knowing initial conditions to infinite degrees of precision is insurmountable. With the weather, one can develop models that will give fairly accurate predictions for two, or maybe three, days in advance; but any farther than that and the accuracy of predictions drops markedly.

Figure 3.2

The Butterfly Effect: How Two Weather Patterns Diverge

From Lorenz's 1961 printouts.



In terms of organizational thinking, one must shift one's attitude toward long-range planning. One may still make long-range plans, but always one must keep in mind the unpredictable flapping of various butterflies' wings in various parts of the system of the organization—either within or without the walls of the building. As Robert Burns said, "The best laid plans of mice and men go oft astray." The butterfly effect suggests that the plans of the mice may interfere with the plans of men (or women) in unanticipated ways.

Thus Wheatley (1999) suggests that organizations not lay their plans in concrete, so that when the unforeseen occurs, there are not outrageous losses in planning time and expenditures. Rather than focusing on analysis and prediction, "we need to know how to stay acutely aware of what's happening now, and we need to be better, faster learners from what just happened" (p. 38).

## Shifting Paradigms of Chaos Theory

Hayles (1990) provides a contemporary, interdisciplinary definition of chaos theory:

Chaos theory is a wide-ranging interdisciplinary research front that . . . can be generally understood as the study of complex systems, in which . . . nonlinear problems . . . are considered in their own right, rather than as inconvenient deviations from linearity. Within chaos theory, two general emphases exist. In the first, chaos is seen as order's precursor and partner, rather than its opposite. The focus here is on the spontaneous emergence of self-organization from chaos; or, in the parlance of the field, on the dissipative structures that arise in systems far from equilibrium, where entropy production is high" (p. 9).

Wheatley's first edition (1992) emphasized this branch of chaos theory in its subtitle:

*Learning about organization from an orderly universe.* The idea is that the apparent chaos of modern organizations has an order not easily apparent to most observers.

Understanding that concept and shifting paradigms from the old Newtonian cause-and-effect way of thinking can actually be stress relieving.

Hayles (1990) describes the second branch of chaos theory:

The second branch emphasizes the hidden order that exists *within* chaotic systems [author's emphasis]. Chaos in this usage is distinct from true randomness, because it can be shown to contain deeply encoded structures called "strange attractors. . . . The strange-attractor branch differs from the order-out-of-chaos paradigm in its attention to systems that remain chaotic. For them the focus is on the orderly descent into chaos rather than on the organized structures that emerge from chaos (pp. 9-10).

Organization writers like Stacey (1996) have been quick to see the significance of this view.

By *chaos*, mathematicians are generally referring to low-dimensional chaos, a pattern of evolution displayed by a deterministic system with many variables, whose flow is restricted to a small space that folds back on itself. . . . The system generating chaos is deterministic and in that sense its behavior is not random, but the specific outcome is indeterminate and in that

sense, perhaps, its behavior is random. This, of course, is counterintuitive, with potentially major significance (p. 57-58).

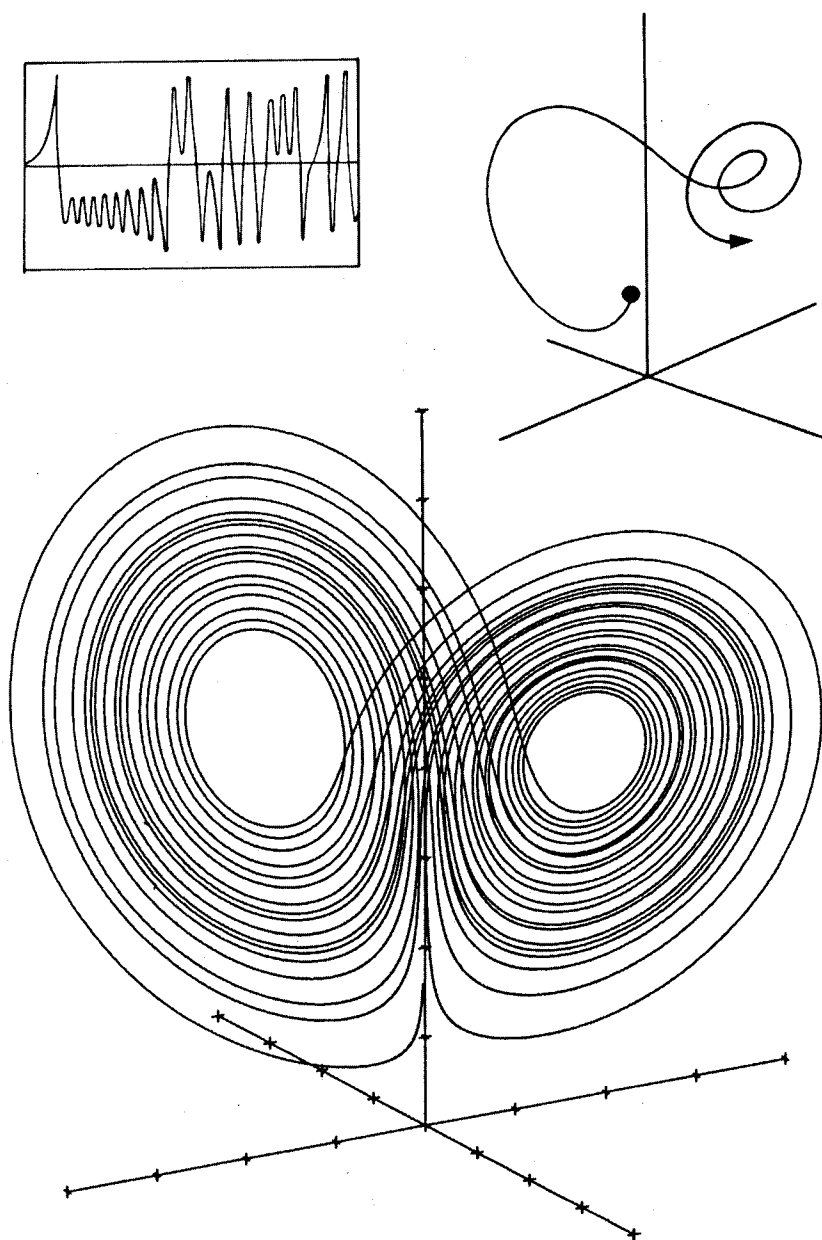
The major significance is in our understanding of how these so-called random systems, when plotted in three-dimensional phase space, build patterns. Lorenz continued his mathematical investigations of nonlinear systems. When he mapped the results onto three dimensional axes (phase planes), he noticed something that did not show up in two dimensions: the system never exactly repeats itself, but the pattern of the system is similar. The shape of that pattern is the “strange attractor.” (See Figure 3.3) The changing values of a variable could be displayed in a time series, as seen at the top of the figure. To show the positions of all three variables, they can be graphed in three-dimensional phase planes. “Because the system never exactly repeats itself, the trajectory never intersects itself. Instead it loops around and around forever” (Gleick, 1987, p. 29. Used with permission.).

The strange attractor in chaos theory has come to have a metaphorical significance in organizational interpretations, representing an underlying, unseen order that emerges from the “chaos” of nonlinear systems.

For Wheatley, this discovery of pattern was featured in the subtitle of the second edition of *Leadership and the new science* (1999), *Discovering order in a chaotic world*. Like Gleick (1987) and Hayles (1990), she chooses to emphasize the multiplicity of meanings and connotations that the word “chaos” carries. Our New Science meaning must now include both understandings of self-organization out of chaos, and of implicit order or pattern that can be uncovered in the heart of chaos. Chaos doesn’t mean the same thing that it did to the ancient Greeks: primeval darkness and fearful uncontrolled

Figure 3.3

## The Lorenz Strange Attractor



unpredictability. Instead, our inability to make long-term predictions and exert control over such nonlinear systems as weather—and our nonlinear organizations, as well—can be balanced by the understanding that sensitive dependence on initial conditions produces “the rich repertoire of real earthly weather, the beautiful multiplicity of it” (Gleick, 1987, p. 23). Rich, beautiful, and complex chaos can now be appreciated rather than feared, for it no longer represents the disorder always before associated with the word.

Priesmeyer (1992) suggests some ways in which chaos theory concepts or methods, especially phase plane analyses, can be used in business to provide a new kind of feedback to organizations—information on how things change. His applications to business statistics will be discussed in more detail in Chapter V, *Conceptual Framework and Educational Research Methodology*. But his purpose in writing his book was to demonstrate that “it is now time for chaos theory to change the way we think about organizations and how we manage them” (p. 5). Management connects with leadership, making a link with applications beyond business organizations.

#### Fractal Iterations

Moving out from that center, within a system, we have an endless process of iteration which is expressed in fractals. “Fractals describe any object or form created from repeating patterns evident at many levels of scale” (Wheatley, 1999, p. 123). Fractals “are characterized by infinite detail, infinite length, no slope or derivative, fractional dimension, self-similarity, and . . . they can be generated by iteration” (Briggs & Peat, 1989, p. 95). Briggs and Peat point out that strange attractors are, in fact, fractal curves (p. 95). If we understand the repeating pattern is a result of self-similarity within a system, we can, Wheatley suggests, focus on qualities of a system, asking these

questions: “How complex is the system? What are its distinguishing shapes? How do its patterns differ from those of other systems?” (p. 125).

#### Dissipative Structures and Turbulence

The New Science concepts of *dissipative structures* and *turbulence* elaborated by Nobel Prize winning chemist Ilya Prigogine and Stengers (1984) are the final keys to understanding systems thinking in a new way. By understanding these concepts, we have a model of the change process in organizations that has great explanatory power.

A dissipative structure in scientific terms is a structure in which a large scale transfer of energy into heat takes place. Stacey (1996) once again gives a lucid explanation of a dissipative structure in chemistry:

A liquid is at thermodynamic equilibrium when it is closed to its environment and the temperature is uniform throughout it. The liquid is then in a state of rest at the global level; that is, it has no bulk movements, although the molecules move everywhere and face in different directions. . . . At equilibrium nothing happens. . . (p. 59).

But if one adds heat to the system, for example, movement begins within the liquid, with the heated molecules rising to the top and pushing other molecules down to the bottom, eventually setting up convection currents within the liquid. “The molecules move in a regular direction, . . . some turning clockwise and others counterclockwise: they self-organize” (p. 62). As more heat is applied, evaporation begins, “a turbulent state of chaos” (p. 62). Stacey contrasts equilibrium with dissipative structures: “An equilibrium structure requires no effort to retain its structure and great effort to change it, whereas a dissipative structure requires great effort to retain its structure and relatively little to change it” (p. 63).

The scientific model of organizational management, similar to closed systems in Newtonian physics, dealt with systems in a state of equilibrium; indeed, the model assumed that equilibrium was the common, perfect state to which all systems aspire. But in the real world, we cannot isolate a system from its environment. Almost all systems are open systems; almost all systems are nonlinear. Very few systems exist in perfect vacuum conditions; no business organization exists independent of its environment. What Wheatley, Stacey, and others suggest is that businesses, rather than reaching for equilibrium, need to strive to become dissipative structures:

A dissipative system imports energy and information from the environment that then dissipate through the system, in a sense causing it to fall apart, but it also has a structure that takes the form of irregular patterns, and it is capable of renewal through self-organization as it continues to import energy and information” (Stacey, 1996, p. 63).

Resistance to change is part of the process: change happens as a result of the frictions caused by colliding ideas. An organization may thus become a “learning organization” in the sense that Senge (1990) uses the term: it can use energy and information to change its structure and thus survive in an increasingly complex world.

*Turbulence* is a term used to describe flow in liquids or gases which is “a mess of disorder at all scales, small eddies within large ones” (Gleick, 1987, p. 122). Turbulence is unstable, random, and highly dissipative, sapping energy and creating drag (p. 122). Generally, in scientific or technological applications, the main focus has been to *reduce* turbulence: constant flow at lower speed and with less disorder is generally preferable and conserves energy. But the onset of turbulence is the beginning of the change process. If we are going to foster adaptive organizations; if we wish to encourage novelty and creativity—then we need to create structures which will allow people within these



organizations to adapt and create without the total collapse or destruction of the organization. Within organizations, a paradigm shift to New Science thinking will follow the point Prigogine and Stengers make in *Order out of chaos* (1984) as Hayles points out:

The essential change is *to see chaos as that which makes order possible*. Life arises not in spite but because of dissipative processes that are rich in entropy production. Chaos is the womb of life, not its tomb” (p. 100).

Thus the view of Prigogine and Stengers is essentially optimistic. It is not sadness that we must endure chaos, but happiness that through this process we will come to a new design, a way to survive, even to possible new life.

Brown and Eisenhardt (1997) suggest that organizations can use the turbulence of the change process to foster creativity by creating what they call “semisttructures”--“some features are prescribed or determined (e.g., responsibilities, project priorities, time intervals between projects) but other aspects are not. Semisttructures exhibit partial order, and they lie between the extremes of very rigid and highly chaotic organization.” Creating such semisttructures can prevent a descent into total chaos, and help the people participating in the change process create solutions within a framework of support.

The organization needs to understand itself and the world it is a part of as an interactive system that is so complex that it is beyond the total understanding of any one person. Thus the new model of leadership in business organizations is one where we no longer rely on just one decision-maker (the CEO) to dictate policy: all stakeholders must be brought in to the decision-making process as equals at the table. The organization will be able to weather the competitive storms and continue to be creative if it can establish a common vision, develop leaders at all levels, and support their creative efforts with semisttructures that allow innovation without damping out change.

Zohar's (1997) leadership chart (used with permission), shown below in Figure 3.4, emphasizes the contrast between Eastern and Western business models, and offers the Quantum as a new alternative.

The East has traditionally been better at developing a common vision among members of an organization; the West has been better at encouraging individual creativity. But neither East nor West is effective at dealing with unexpected change, and both "seek to dampen down or exclude the unexpected" (1997, p. 129). Conversely, in our twenty-first century world—if we take a New Science perspective—both East and West must learn to thrive on the unexpected so that organizations may thrive and grow in an increasingly complex world.

#### The Impossibility of Prediction

The essential lesson of quantum physics and chaos theory—taken together—according to Wheatley (1999), is that

it is impossible to ever predict exactly where or when influences will manifest. This is hardly a comforting thought to those of us trying to lead organizations, yet the imagery of quantum leaps more accurately reflects my experience of organizational and societal change than any other ( p. 44).

The fall of the Berlin Wall in 1989, and the subsequent reunification of Germany, as well as the dissolution of the Soviet Union in 1991 are two significant, unanticipated historical changes which support the idea of the quantum leap.

Figure 3.4

## Self and Organization, West, East and Quantum

*THE QUANTUM MODEL*

<b>West</b>	<b>East</b>	<b>Quantum</b>
Conflict and Control	Cooperation	Dialogue
Self (the personal) wholly excluded and isolated; interactions grounded in universal principles	Self (the personal) wholly embedded and contextual; no universal principles	Self (the personal) embedded and contextual with universal dimension
Stability achieved through excluding the self and the emotions, and organizing only the predictable and controllable aspects of relationships	Stability achieved through reinforced familiarity and discipline of the self.	Stability balanced with instability.
Rigid boundaries	Ambiguous boundaries	Flexible boundaries
Dictatorial leadership	Consensual leadership	Leader relies on trust and feel for situation
Rule-bound	Habit-bound	No set framework from rules or habits
Mechanical	Organic	Both naturally unfolding (organic) and that which can be made from it (mechanical)
<b>Both</b>		
Rely on stability		
Weak in dealing with unexpected change		Open to change
Seek to dampen down or exclude the unexpected		Thrives on unexpected

Zohar, D. (1997). *Receiving the corporate brain: Using the new science to rethink how we structure and lead organizations*. San Francisco: Berrett-Koehler Publishers, Inc.

## New Science Understandings of Organization

Quantum understandings of particles and the butterfly effect produce a new view of the role of the individual in a large system, as Wheatley (1999) points out in her second edition:

A quantum view explains the success of small efforts quite differently. Acting locally allows us to be inside the movement and flow of the system, participating in all those complex events occurring simultaneously. We are more likely to be sensitive to the dynamics of this system, and thus more effective....Every small system participates in an unbroken wholeness. Activities in one part of the whole create effects that appear in distant places. Because of these unseen connections, there is potential value in working anywhere in the system. We never know how our small activities will affect others through the invisible fabric of our connectedness. I have learned that in this exquisitely connected world, it's never a question of 'critical mass.' It's always about *critical connections*[author's emphasis]. (p. 45).

The new science organization is thus about those connections or relationships and about participation. "Participation, seriously done, is a way out from the uncertainties and ghostly qualities of this nonobjective world we live in. We need a constantly expanding array of data, views, and interpretations if we are to make wise sense of the world. We need to include more and more eyes. We need to be constantly asking: "Who else should be here? Who else should be looking at this?" (Wheatley, 1999, p. 66). The purpose is to develop a culture within the organization where everyone is always asking those questions and reflecting on possible future scenarios.

But within organizations, as we strive to create that culture, we need to come to grips with an essential paradox: how can we come to see the wholeness of nature if we can't analyze it in Newtonian way, adding up the sum of the parts to understand the whole? Wheatley (1999) explains it this way:

We can discover the whole by going further into its parts. While this sounds like good old-fashioned reductionism, it is quite different. We inquire into the part as we hold the recognition that it is participating in a whole system. We hold our attention at two levels simultaneously. . . . We can understand the whole by noting how it is influencing things at this local level. This manner of thinking, while difficult to grasp for a Western mind, is familiar in Buddhist belief (Wheatley, 1999, p. 141).

The connection with Buddhist thinking (because of the embracing of opposites—yin and yang—mentioned before) helps to explain the Eastern philosophy which permeates so many contemporary books on business organization and management. Capra's *The Tao of Physics* (Second Edition, 1985/originally published in 1975) makes the connection between quantum physics and Eastern thinking specific, and organization thinkers continue to see the benefits of seeing organizations as wholes rather than breaking everything into discrete boxes and partitions.

The quantum world and the quantum organization is a process place, again emphasizing the concept of relationship: “We need to see these plans, standards, organization charts not as objects that we complete, but as processes that enable a group to keep clarifying its intent and strengthening its connections to new people and new information . . . Healthy processes create better relationships among us, more clarity about who we are, and more information about what’s going on around us” (Wheatley, 1999, p. 155).

For a group of people to “strengthen its connections to new people and new information”—that is truly a statement of purpose for a school engaged in the process of developing life-long learners.

## New Science Schools

*So what should we do while we're waiting for the revolution?*

*How can we create schools that will embrace these New Science organizational constructs, and how will these schools be different from the schools we have now?*

The paradigm shift from Newtonian to quantum thinking is already underway (Hayles, 1990; Priesmeyer, 1992). To the extent that Senge (1990) and Wheatley (1992/1999) focus on love, caring, mastery, and vision—as opposed to profit—as central tenets for their organizational structures, they provide foci that are appropriate to schools.

### Schools Facing Change in a New Way

Havens' (1997) dissertation has shown a parallel development between *educational* organizations, management, and leadership, and *organizational* management and leadership in general. She makes the school connection by relating the viability of organizations to the processes with which they function: “Organizations remain viable systems through dissipative and self-organizing processes that are creative and changing through unstable and unpredictable chaotic processes, while, paradoxically, remaining consistent and resilient” (p. 66), thus her definition refers to schools as dissipative structures—that kind of system which must constantly import energy (see Table 1, in Chapter I, p. 5). What we want for our schools is for them to become both creative and consistent in facing the changes of the future.

If leaders and teachers understand New Science models of organizational change, they can help schools to change more quickly and with less trauma in an increasingly complex and changing world. Those who have studied change processes in the schools (Fullan, 1991; Darling-Hammond, 1993; Wagner, 1994) all agree that new attitudes are

essential in creating a climate where change can take place effectively. Schools must have teachers, parents, administrators, and students who are open to change, willing to be flexible rather than rigid, and able to adapt the focus of curricula to suit individual and institutional preferences.

The changes in attitude are already underway in many places. Like the rotating molecules in a beaker to which heat is being added, we want schools that are dissipative structures—adaptive and constantly changing. Thus, we must have teachers, principals, parents, and school board members who embrace *change* as a central part of the learning experience. That is a tremendous shift of *attitude* rather than a structural change. Some schools are embracing this attitude, but in many schools and communities, there is suspicion of new ideas and suspicion of change itself. Parents and board members, and even some teachers and principals may ask, “Why do we need this change? We didn’t do things this way when *I* was in school!” But resistance to change is part of the change process within the system, too: it is the result of the friction within the system that causes heat. It is a healthy part of the process. We need leaders and followers in schools who do not fear the change process but understand and accept it in the same way that we all understand and accept the turning over of the seasons from summer to fall (Barnett, 2003). Within that period the tree is in a constant state of flux and disorder as the leaves go from green to brown, fall to the ground and disintegrate. Yet no one panics. It is part of the natural order. School people must come to see school changes in the same way.

#### The Coalition of Essential Schools Representing New Science Ideas

The Coalition of Essential Schools, founded on the work of TheodoreSizer (1984, 1992) at Brown University, has provided a model for schools that value change in an

information age. The principles of the Coalition of Essential Schools are essentially New Science principles. Even the way in which Coalition schools apply their ten principles is quantum in approach:

The Common Principles do not provide a fixed approach to change. Rather, they are used to focus each school's effort to rethink its priorities and redesign its structures and practices. Each school develops its own programs, suited to its particular students, faculty, and community (Coalition).

The Coalition has discarded the "template" of change: instead, the *process* is emphasized, so that solutions can be found which fit the individual character of the organization.

Coalition principles of curriculum development, similarly, embody New Science principles. The idea of "less is more" focuses on a skills-based curriculum that is individualized to suit the particular students rather than a content-based curriculum in which fixed amounts must be "covered." Principles embodied within a discipline are the "essential" or necessary learnings. In the Information Age, the problem is no longer finding information, but sifting through the mountains of available information and making sense of it all. The word "factoid" has come into use to describe isolated facts, unconnected with a body of theory or meaning, and thus essentially meaningless. The Coalition approach to curriculum recognizes that, and urges its schools to use the key concepts in each discipline to structure learning, rather than insisting on the rote memorization of hundreds of facts or factoids, which may be seen as truly a Trivial Pursuit.



## Changing School Structure to Reflect New Science Thinking

But structure is a part of school improvement, too. To the extent that schools have become bureaucratic, or have imitated the corporate structures of scientific management, they have taken on the liabilities of such structures in an age of rapid change. New Science schools need to be quickly adaptive, and cannot depend upon layers of administrative trickle-down for change.

Books have been written about school structures—with Sizer's *Horace's school* (1992) providing a contemporary ideal within the Coalition of Essential Schools' model. The attitude changes are the essential changes although perhaps changing those attitudes is more difficult than changing structure, which can be done by administrative fiat, top-down. But changing the structure *without changing the attitudes* will not result in lasting change; the studies in school change have demonstrated that (Wagner, 1994, p. 235; Fullan, 1994).

*A typical elementary school is already a quantum model*, in that each teacher in her or his classroom is typically seen as having autonomy to create the learning atmosphere and dynamic within the classroom. In traditionally structured elementary schools, we have a classroom of fifteen to twenty elementary students (ideally) with their teacher; and we have a principal in a similar relationship to his or her group of teachers. Elementary classrooms are holistic: subjects and curriculum are integrated; relationships with parents are fostered and nurtured. In elementary classrooms where "looping" is practiced, even more artificial divisions may be eliminated, as students may progress through first, second, and even third grade curricula with the same teacher in the same classroom.

A typical high school has many more artificial structures with which to contend. First, rather than 20 students, the typical high school teacher has from 80 to 120 students in five classes a day. The five-fold increase in numbers of students makes the close parent contact of elementary school a near-impossibility. Instead of an integrated curriculum, most high schools have subject divisions (math, language arts, social studies, science) and department identifications and an emphasis on content instruction. These divisions contribute to the lack of openness. Senge (1990) describes how restrictive such organization can be in reducing the sense of “the mysterious. . . the source of all true art and science” (Einstein, as qtd. in Senge, 1990, p. 283):

Unfortunately, the way knowledge is organized and structured in contemporary society destroys this sense of mystery. The “compartmentalization of knowledge” creates a false sense of confidence. For example, the traditional disciplines that influence management—such disciplines as economics, accounting, marketing, and psychology—divide the world into neat subdivisions within which one can often say, “This is the problem and here is its solution.” But the boundaries that make the subdivisions are fundamentally arbitrary. . . Life comes to us whole. It is only the analytic lens we impose that makes it seem as if problems can be isolated and solved. When we forget that it is “only a lens,” we lose the spirit of openness (p. 283).

The spirit of openness is frequently lost in school settings, and the larger the school, the more likely it is to be floundering, unless structures are established to create smallness within the larger structure.

#### Strengthening Relationships in Quantum Schools

In a quantum school, we need many ways to strengthen relationships which are now ignored or cut off. We need good communication in all directions. We need all stakeholders feeling as if they are “at the table.” Some of the semistructures suggested by the reform movements of the 1980s and 1990s are interdisciplinary teams or “houses”

which create identifiable groups within the larger school. And the larger the school, the more need there is for similar ways to keep the vision burning.

A key area of overlap between Senge's (1990) work and the field of education is that his goal is to create a *learning* organization. Most educators think of schools as learning organizations, although the purpose of schools is advancing individual student learning, rather than advancing the learning of the organization as a whole or earning a profit. In fact, Senge's definition of an organization committed to personal mastery is a fine definition of a school: "An organization committed to personal mastery can provide [a supportive] environment by continually encouraging personal vision, commitment to the truth, and a willingness to face honestly the gaps between the two" (1990, p. 173). That willingness to honestly face the gaps between one's vision or goals and where one is, is at the heart of the learning process in which the teacher, together with the student, evaluates the student's skills and knowledge and then designs lessons to enable the student to reach their shared goals. When students are actively engaged in the design and the experience of planning, the process is even more likely to be successful, especially at the high school level.

A key to Senge's learning organization and to the success of schools is to build in an opportunity to reflect on practice. Senge (1990) cites Schon, author of *The reflective practitioner*, and at the same time condemns traditional schools in which "teachers are bound by a bureaucratic organization that discourages time to reflect" (p. 303). "If the teacher must somehow manage the work of thirty students in a classroom, how can she really listen to any one of them?" Schon asks (as quoted in Senge, 1990, p. 303).

Reflective practice, Senge believes, is critical for managers and leaders. While typical

managers “adopt a strategy, then as soon as the strategy starts to run into problems, they switch to another strategy, then to another and another” (Senge, 1990, p. 303). Similarly, one sometimes hears teachers say, “Well, I tried that once; I’ll never do *that* again!” A practice grounded in quantum thinking and chaos theory would suggest that each classroom configuration is different, and that what worked or didn’t work on one occasion may well fail or succeed on another day with the same group, or with a different group. Reflective practice—in which one analyzes the components of the activity, evaluates success and failure, and redesigns activities in light of what one knows about the learners in the particular situation—may be the key to creating success the next time around.

Senge’s desire to create “lifelong learners” in his business organizations, who practice “‘reflection in action,’ the ability to reflect on one’s thinking while acting” (1990, p. 192), who can tune in to what’s going on while it’s happening can equally well be applied to schools. Schon suggests that “Phrases like ‘thinking on your feet,’ ‘keeping your wits about you,’ and ‘learning by doing’ suggest not only that we can think about doing but that we can think about doing something while doing it” (as quoted by Senge, 1990, p. 192). Most classroom teachers understand and are able to make use of the “teachable moments” that arrive without advance planning. To take advantage of these learning opportunities, flexibility is required of teachers and curricula. These values serve the dissipative system as a strange attractor. This model explains how that happens from an emergent, natural, holistic perspective.

The key to this learning organization, according to Senge (1990) is this: “All in the organization must master the cycle of thinking, doing, evaluating, and reflecting.

Without, there is no valid learning” (p. 351). We have come back to the ideas of the great early-twentieth century educator John Dewey, but with the added weight of quantum physics and nonlinear dynamics to support the concept of learning by doing.

### Linking Up with Love

Perhaps the most surprising idea for a business book in Senge’s *Fifth discipline* (1990) is the idea “of living our lives in the service of our highest aspirations” (p. 8), which Senge first connects with the idea of personal mastery and later links with the “spirit of love” in organizations (p. 285). He admits that “love is . . . a difficult word to use in the context of business and management,” but then goes on to connect the word with learning within the organization in the most idealistic, educational, and spiritual sense:

[Love] has everything to do with intentions—commitment to serve one another, and willingness to be vulnerable in the context of that service. The best definition of the love that underlies openness is the full and unconditional commitment to another’s ‘completion,’ to another being all that she or he can and wants to be” (p. 285).

This definition fits well with Noddings’ (1984) ethic of care. It describes what every teacher wants for each student in her class; what every principal wants for the teachers in her charge; what each superintendent wants for the principals who lead her schools. The pattern of learning plays out in fractal similarity across various scales within the learning organization of the school or the school system.

### Creating a Personal School

A key idea for our 21<sup>st</sup> century school is the paradox of local vs. global. This is the concept that is emphasized by the New Science concept of fractal iterations, repeated on smaller and smaller scales. The shared vision which guides the school, crafted with

the contributions of all stakeholders, is the global principle, but within that school we must have ways to resist the social consequences created by “the rise of mechanism and the associated rise of industrial society” (Zohar and Marshall, 1994, p. 257). Those consequences are “bigness, rationalism, and bureaucracy” (p. 257). We want our New Science school to encourage local action through empowerment. As the Coalition of Essential Schools suggests, personalization creates more effective schools. Schools need to design semistructures that create that sense of personalization and connection for their students.

#### New Schools Need New Leaders: The Principal as Steward

And the leader (principal) has a special role in this learning organization—or school—“leaders are designers, stewards, and teachers. They are responsible for building organizations where people continually expand their capabilities to understand complexity, clarify vision, and improve shared mental models—that is, they are responsible for learning” (Senge, 1990, p. 340).

In her conclusion, Havens (1997) proposes “a new mindset which recognizes the dynamic interconnectedness of all things,” with the goal of creating “new patterns and pathways of becoming, not only for schools and those within schools, but eventually spreading out in iterative and inclusive patterns affecting everything and everyone” (p. 187). To get there, one needs a place to start, and one place is always with the role of leader. Chapter IV looks at the role of the leader for the school, focusing on the high school principal specifically, but recognizing that a twenty-first century school leader’s purpose is to grow new leaders, and to create respect and support for all members of the system in their individual searches for learning and mastery.

## CHAPTER IV

### A NEW SCIENCE MODEL FOR THE EDUCATIONAL LEADER

RESEARCH QUESTION: 3. What model for understanding educational leadership is appropriate for the twenty-first century?

*We have conceived of leadership. . . as the tapping of existing and potential motive and power bases of followers by leaders, for the purpose of achieving intended change. . . . Ultimately education and leadership shade into each other to become almost inseparable, but only when both are defined as the reciprocal raising of levels of motivation rather than indoctrination or coercion "(Burns, 1978, p.448).*

Leadership has been a topic for theory and research since before the times of Plato and Aristotle; Senge's (1990) and Wheatley's (1992/1999) offerings are only two small streams feeding a late twentieth century Niagara of publications on leadership in all fields. But before we look at how these streams come together to form a model of leadership, we need to discuss the appropriateness of organizational models of leadership for schools. Are theories of management, organization, and leadership of *corporations* transferable to and appropriate for *schools*?

#### Are Business Models Appropriate for Schools?

Sergiovanni (1996) Says "No!"

*In Leadership for the schoolhouse: How is it different? Why is it important?*

Sergiovanni (1996) makes the case that borrowing from business theories does not serve the purposes of schools. He presents three cases of business theories that have been tried out in schools without long-term positive results, and concludes

In all three, schools are understood as formal organizations. Understanding corporations, armies, research laboratories, transportation systems, universities, government bureaus, and fast-food restaurant chains as formal organizations makes sense. But the organization metaphor does not fit the nature of school purposes, the work that schools do, the relationships needed for serving parents and students, the context for work that teachers need to be successful, or the nature of effective teaching and learning environments (p. 13).

It seems as if Sergiovanni is denying that schools are organizations. But while it is true that schools are not factories, and students are not products, the other things that Sergiovanni is emphasizing are all *relational*: the work that schools do—providing structure and content for student learning; the relationships teachers foster with parents and students; the context for successful teaching—emphasizing motivation and the development of self-management skills in students; the nature of effective teaching and learning environments—supportive, positive, rigorous. Many business writers (e.g. Posner & Kouzes, 1995; Senge, 1990; Wheatley, 1992/1999; Zohar, 1997) and organizational theorists recognize the importance of these relationships which go beyond “the bottom line” in creating a positive, motivated corporate culture. Surely Senge (1990)—with his emphasis on the disciplines of *vision*, *personal mastery*, and *team learning*—is aware of the importance of these concerns even in businesses with a profit motive (as opposed to nonprofit organizations or businesses, whose leaders might seem to share the same altruistic motivations of school leaders).

Contradictions in Sergiovanni’s (1996) Views

#### Conflicting Views on Chaos Theory

Sergiovanni (1996) also specifically praises and criticizes chaos theory in the same breath:



From Chaos Theory comes a burgeoning and useful literature on self-managing systems and learning organizations—places where people can become self-organizing and self-developing. I believe we can learn a great deal from Chaos Theory, but I do not believe that Chaos Theory can be used to develop a working theory for the schoolhouse (p. 41).

Chaos theory, Sergiovanni says, is unsuccessful in its application to schools “when we get to the cultural side of human nature—the side that allows us to believe, to sacrifice, to strive for goodness, to be motivated out of altruism, to care for ideas and principles, to be moral persons” (p. 42). Schoolhouse theory, he says, must “[place] moral authority at the center” (p. 43). Burns (1978) argues that having moral authority as the central focus is exactly what is needed in public and private institutions. Sergiovanni seems unaware of the clear commitment to relationship and to moral authority expressed in Senge (1990) and Wheatley (1992),

#### Placing “Moral Authority” at the Center

Senge’s (1990) work does exactly that, by making “the learning organization” the focus. Sergiovanni’s charge seems to be that chaos theory is amoral. While one does not, in general, associate morality with mathematics and science, the organizational interpretations that have come out of chaos theory have focused on connecting with “higher principles”—both of the leader and for the organization. Senge’s (1990) “purpose stories” of corporate leaders are an excellent illustration of altruistic morality and higher purpose. A purpose story is “the overarching explanation of why they [CEOs] do what they do, how their organization needs to evolve, and how that evolution is part of something larger” (p. 346). The “something larger” in the purpose story goes beyond the bottom line to connect with the most altruistic and moral concerns, as Senge describes it:

The leader's purpose story is both personal and universal. It defines her or his life's work. It ennobles his efforts, yet leaves an abiding humility that keeps him from taking his own successes and failures too seriously. It brings a unique depth of meaning to his vision, a larger landscape upon which his personal dreams and goals stand out as landmarks on a longer journey. But what is most important, this story is central to his *ability to lead*. It places his organization's purpose, its reason for being, within a context of "where we've come from and where we're headed," where the "we" goes beyond the organization itself *to humankind more broadly* [italics added]. In this sense, they naturally see their organization as *a vehicle for bringing learning and change into society* [italics added] (p. 346).

Senge goes on to quote several CEOs in his section on the "Leader as Steward." He quotes Bill O'Brien of Hanover Insurance (p 346-348), Ed Simon of Herman Miller (p. 348-349), and Ray Stata of Analog Devices, Inc. (p. 349-351). O'Brien's words illustrate the deeply moral nature of his vision for the organization he heads:

This is the quest we at Hanover have been on for almost twenty years now—to discover the guiding principles, design, and tools needed to build organizations more consistent with human nature. . . We set out to identify and eliminate the diseases that afflict hierarchical organizations and make them inconsistent with the higher aspects of human nature. . . . There's an enormous reservoir of untapped potential in people that can be channeled more productively than it is, . . . to build a value-based, vision-driven environment.

Mankind's nature is to ascend to greater awareness of our place in the natural order, yet everywhere we look we see society in a terrible mess of self-centeredness, greed, and nearsightedness. In modern society, business has the greatest potential to offer a different way of operating. The potential of business to contribute toward dealing with a broad range of society's problems is enormous. But we must show the way by example not by moralizing. We must learn how to harness the commitment of our people—then our commitment to building a better world will have some meaning (p. 347-348).

For an organization to have the stated goal of "building a better world" would seem to place a moral concern at the center of the business. If Sergiovanni claims such a business model lacks a moral center, he is certainly missing the point. You can't get much more altruistic than the statement above. Educators are used to felt values of this

kind—although they may often go unexpressed—but seldom do we anticipate that corporate leaders will share such values. That unexamined assumption has led to a deep suspicion of the motives of business leaders, a suspicion that Sergiovanni seems to share. (The most recent big-business fiascos have not done much to improve the tarnished image of the business leader.)

In *Rewiring the corporate brain: Using the new science to rethink how we structure and lead organizations*, Zohar (1997) suggests that contemporary organizations and leaders need to meld business values with deeper spiritual values such as “service to the community, care for the environment, concern for human happiness” (p. 73). Beyond this, she concludes with a chapter on “Servant Leaders,” who

lead from that level of deep, revolutionary vision. . . . They change the system, invent the new paradigm, clear a space where something new can be. They accomplish this not just from ‘doing,’ but more fundamentally, from ‘being’” (p. 146).

Truth-telling and integrity are at the heart of Senge’s (1990) *Fifth discipline* model of “leader as steward,” and Zohar’s (1997) “servant leaders” have the moral core that Sergiovanni claims business/organization models lack. Thus these particular business models—Senge (1990); Wheatley (1992/1999); and Zohar (1997)—all operate from a moral perspective that is central rather than peripheral, and thus meet Sergiovanni’s requirements in terms of moral leadership for the schoolhouse.

#### Burns’ (1978) Transformational Leader

Having established the acceptability of these particular models for school leadership, the next step is to establish a theoretical definition of leadership based on Burns’ (1978) model, to look at how leadership of schools is similar to leadership of countries and of business organizations, and then to focus on the qualities of leadership

most important in an organization of any kind in which a New Sciences' worldview is adopted. Once the theoretical concept of leadership in the school is defined and elucidated, the focus will shift to the position of high school principal as leader.

#### Burns' Transactional Leader

Burns' (1978) *Leadership* established a definition of leadership in the historical and political sense; his definitions of *transactional* and *transformational* leaders have gained wide acceptance in many fields. According to Burns, a *transactional* leader seeks to connect with followers by "exchanging one thing for another" (p. 4). In a high school setting, one can imagine that a *transactional* principal might establish a disciplinary contract with the teachers—teachers would routinely handle minor classroom infractions and/or rambunctiousness with after-school detention and calls to parents; the principal would take referrals to her office only for the most serious situations and would mete out discipline as necessary to support the teacher's creation of a learning atmosphere. By agreeing to provide disciplinary support in this way, the principal gives the teacher what the teacher wants: relief from classroom disruption and the opportunity to teach effectively. The principal also insures that the school maintains the learning atmosphere that everyone wants—parents, teachers, administrators, school board members, community members, and other students. The key to transactional leadership is that it is contractual and managerial. (In business settings, the office manager often plays a transactional role.) The leader has the power to meet the terms of the contract, and does what is expected to meet the needs of the followers. The followers cooperate in order for the needs of the school as a whole to be met.

## The Higher Leadership—Transformational

But, Burns (1978) tells us, there is another, higher type of leadership—what he calls *transforming* leadership—which

recognizes and exploits an existing need or demand of a potential follower. But. . . looks for potential motives in followers, seeks to satisfy higher needs, and engages the full person. [It is this process] that converts followers into leaders and may convert leaders into moral agents (p. 4).

There are two aspects of this model which make Burns' concept of *transforming* leader especially suitable for school leadership. First is the necessity of meeting the "higher needs" of the followers. Burns talks in terms of Maslow's (1943) hierarchy of needs, and believes that transforming leaders seek to meet the needs and aspirations of the followers, going beyond those more basic needs (such as a need for order) which might be adequately addressed in a transactional way. Second is the emphasis on the reciprocal relationship that exists between leader and follower(s) in cases of transforming leadership: it is a profoundly moral relationship in that "it raises the level of human conduct and ethical aspiration of both leader and led, and thus it has a transforming effect on both" (p. 20). In both of these aspects, Burns meets the criteria suggested by Sergiovanni (1996) for *moral leadership* for the schoolhouse. The concepts of "leader as steward" (Senge, 1990), "servant leader" (Zohar, 1997), and leaders as "gardeners, midwives, . . . missionaries, facilitators, conveners" (Wheatley, 1999, p. 165) all provide a new image for leaders, different from the hard-nosed CEO who cares only about the bottom line.

The Transformational Leader Empowers. Burns (1978) would agree with Sergiovanni's position that schools are not factories and students are not products. Burns provides more support for the idea of *empowerment* (of teachers, students, perhaps

parents—all those with less power, in a traditional system) by emphasizing reciprocity in learning and relationship in terms that will have a familiar sound to those used to the metaphors of chaos, turbulence, and flow:

We always find a stream of evolving interrelationships in which leaders are continuously evoking motivational responses from followers and modifying their behavior as they meet responsiveness or resistance, in a ceaseless process of flow and counterflow (p. 440).

Leaders thus are influenced by the high aspirations of their constituencies, shape those aspirations into achievable vision, and transform both themselves and those who follow them in the process. Gandhi is the historical example Burns gives of such a leader. Gandhi redefined leadership in his lifetime, taking the self out of it and converting it to energy to do work. Transformed people become transformed as they shape their aspirations into achievable visions.

#### The Transformational Leader Understands Change

As Gandhi demonstrated, a leader must do more than merely *possess* an idealistic dream or vision, although that vision is a necessary starting point for creating change. Burns concludes that the leader must create “intended, real change that meets people’s enduring needs” (p. 461). That is the practical test of leadership, and it will be the criterion for our study, as we compare two high schools with varying degrees of change and examine the leadership exerted to move them toward change and the forces which inhibited them—perhaps despite the change-focused intentions of their leaders. Leaders in any organization, then, must understand the change process. In his description of change, Burns (1978) again foreshadows Senge (1990) and Wheatley (1992). In discussing why plans for change go awry, Burns suggests that sometimes it’s because they’re not good plans, sometimes it’s because of unforeseeable bad luck, but most often it

is because the planners fail to give enough attention to “the psychological and structural forces” (p. 419) that can inhibit change, especially in bureaucratic organizations. He counsels *against* seeking consensus in the planning process—it is “deceptive and dangerous” (p. 420). Instead, he says, in response to multiple sets of values among constituencies, “*advocacy and conflict* must be built into the planning process” (p. 421). Thus Burns suggests that in order to facilitate change, one must foster a sense of conflict and avoid consensus. A New Science thinker might say one must *embrace chaos*.

#### The Leader as Revolutionary

Leading a People’s Organization with Saul Alinsky (1946, 1971)

Saul Alinsky’s counter-culture manuals *Reveille for radicals* (1946/1969 Vintage Books edition) and *Rules for radicals* (1971) help to elaborate on the change and planning process for leaders who want to build a “people’s organization,” (1946, p. 203). One must have “the infinite patience and faith to hang on as parts of the organization disintegrate; to rebuild, add on, and continue to build” (1946, p. 203), because “*All change means disorganization of the old and organization of the new* (1971, p. 116). So a leader of the people, like a leader of a school, must be able to face—and even encourage and welcome—that disorganization. And although Alinsky recognizes and recommends reflection as a necessity for the revolutionary leader—suggesting the leader’s jail time as a great opportunity for reflection—he paradoxically recommends acting rather than hesitating: “*Tactics, like organization, like life, require that you move with the action*” [Alinsky’s emphasis] (1971, p. 136). The particulars of the local situation, he tells us, in New Science language, will never exactly repeat themselves:

People, pressures, and patterns of power are variables, and a particular combination exists only in a particular time—even then the variables are constantly in a state of flux. . . It is the principles that the organizer must carry with him in battle. To these he applies his imagination, and he relates them tactically to specific situations (1971, p. 138).

Thus the vision and principles are the essentials that help the revolutionary leader to create change. And change happens by seizing opportunities and moving with the flow.

Alinsky seems to have been a key part of the concept of “going with the flow” as he describes the process of developing leadership tactics: “The tactic itself comes out of the free flow of action and reaction, and requires on the part of the organizer an easy acceptance of apparent disorganization. The organizer goes with the action” (1971, p. 165). Alinsky spends a paragraph criticizing schools for creating an atmosphere which stifles acceptance of the idea that—like Abraham Lincoln at the beginning of the Civil War—the best policy is to have no policy (1971, p. 166). Instead, he claims, schools force us to reject outright any thing that doesn’t fit into the accepted pattern of analysis which emphasizes “order, logic, rational thought, direction, and purpose” (p. 166). For Alinsky—far more comfortable with chaos than with order—it’s not so much that *order*, *logic*, and *rational thought* are dirty words, as that “this is not how it is in real life” (p. 166). Real life does not fit neatly into little rational boxes: it is messy, disorganized, and ever changeable.

#### Going With the Flow: Tactical Sensitivity

So in real life, the leadership tactic must be “part accident, part necessity, part response to reaction, and part imagination” (Alinsky, 1971, p. 168). Alinsky’s “imaginative organizer” (our *educational leader*) makes good use of the accidents as the golden opportunities they are, and calls it “tactical sensitivity” (p. 168).



Alinsky's purpose is to describe the process by which revolutionary leaders can take advantage of what is happening in order to advance the causes of the revolution; psychologist William Bridges (1980) cites Toynbee (*The study of history*) in which Toynbee observes that societies must undergo a period of disorganization before any new plan can emerge with new energy: "Things end, there is a time of fertile emptiness, and then things begin anew" (p. 82). Understanding that characteristic historical pattern in New Science terms, we must shift our thinking to a new understanding of change—not as something to be feared or dreaded, but as part of a cycle of regeneration out of which will emerge new growth. For Bridges, it is a way to personal growth; for high school leaders, it is a way to keep schools growing and adapting in order to meet the constantly changing needs of the students and the society they will soon join.

Interstate School Leader's Licensure Consortium Crafts Standards for School Leaders  
(1996)

That focus on promoting the success of all students was the heart of the *Interstate School Leaders Licensure Consortium (ISLLC) Standards for School Leaders*, adopted in 1996. In crafting their six standards for leadership, they use seven principles:

- the centrality of student learning
  - the changing role of the school leader
  - the necessity for high standards
  - the necessity of performance-based assessment and evaluation
  - the necessity of integration and coherence
- the concept of empowerment for all members of the school community  
(Council 1996, "Guiding Principles," p. 7).

For each standard, the Council elucidates *Knowledge*, *Dispositions* and *Performances*.

Dispositions are proclivities or tendencies which lead in a certain direction. Without them, the action of performance has little meaning.

The Council's six standards follow.

**Standard 1:** A school administrator is an educational leader who promotes the success of all students by **facilitating the development, articulation, implementation, and stewardship of a vision of learning that is shared and supported by the school community.**

**Standard 2:** A school administrator is an educational leader who promotes the success of all students by **advocating, nurturing, and sustaining a school culture and instructional program conducive to student learning and staff professional growth.**

**Standard 3:** A school administrator is an educational leader who promotes the success of all students by **ensuring management of the organization, operations, and resources for a safe, efficient, and effective learning environment.**

**Standard 4:** A school administrator is an educational leader who promotes the success of all students by **collaborating with families and community members, responding to diverse community interests and needs, and mobilizing community resources.**

**Standard 5:** A school administrator is an educational leader who promotes the success of all students by **acting with integrity, fairness, and in an ethical manner.**

**Standard 6:** A school administrator is an educational leader who promotes the success of all students by **understanding, responding to, and influencing the larger political, social, economic, legal, and cultural context.**

The ISLLC standards reflect the view of leadership as a process of interactions with students, teachers, and community stake-holders. Vision, a key component for Senge (1990) and many other business writers, is the first standard in this list. Senge (1990), and Senge et al. (1999) and Senge, et al. (2000) are cited in the references, as is

Wheatley (1992). The “old role” of maintaining organizational equilibrium and handling outside demands is covered in Standard 3. Standards 4, 5, and 6 all deal with *relational* aspects of the job of school leadership: collaboration (teamwork), understanding and dealing with social and political dynamics, fair and ethical actions. This fits in with the emphasis on systems thinking and relationship that are key to the New Sciences thinking. But although the ISLLC standards are not intended to be a checklist, there is always the danger that such a list will limit rather than expand a leader’s opportunities. Wallace, Sweatt, and Acker-Hocevar (1999) suggest that the rubric-formatted ISLLC standards are “inadequate to measure the dynamic, adaptive, creative nature of outstanding leadership” (p. 22), because the tendency is to use such a standards list as a “prescriptive checklist” of traits and skills, from which one might infer that all principals might be judged using the same values. Instead, Wallace et al. (1999) offer an Open-Systems Framework for Selection and Recognition of Emerging and Outstanding Educational Leaders (p. 27), which focuses on three general areas of leadership: personal, organizational, and relational. Within those three areas, they include self-mastery and lifelong/purposeful learning; understanding of open systems thinking, the potential of team building; involving teachers and parents in decision-making. Although their framework is structured a bit differently, essentially it covers the same areas as Senge’s five disciplines: personal mastery, mental models, shared vision, team learning, and systems thinking. Most importantly, Wallace et al.’s Open-Systems Framework, they suggest, permits the more natural interaction of leader and setting, and allows for a more personalized analysis of creativity and individuality.

## The Quantum Principal's New View of Change

### New Science Leaders Require New Understandings

If schools and their administrators are to function effectively in the world of the New Sciences, they must understand the process of change differently. They must understand the organizational structure of the school as a dissipative structure needing continual inputs of energy, and they must see the process of planning and change as a continuous evolution rather than as something to be accomplished and done with.

### Establishing Strategic Direction

Sullivan (1999) suggests that members of an organization must engage in dialogue “to establish strategic direction by making the best choice from a *contingency of futures*[italics added]” (p. 419), and “to collaborate to the point of accepting a *shared global vision* [italics added]of themselves and the world around them” (p. 420). By stressing the equality, responsibility and accountability of stakeholders, Sullivan suggests, an organization can change its path, “allowing many different project developments to influence each other” (p. 420). The leader’s job in this organizational functioning is to use his intuition to feel “the simple and small changes within the system of education and [apply] gentle creative action in the appropriate places” (p. 421). This is very much like Alinsky’s recommendations for tactics in achieving revolution, but here the goal is “achieving a renewed and improved system of education” (p. 422).

### Disrupting Equilibrium

Twenty-first century leaders of schools, like CEOs of Senge’s learning organizations (1990), must do *more* than “maintain organizational equilibrium” (Wallace et al., 1999, p. 26). Maintaining equilibrium was the goal in the Newtonian model, in

which equilibrium was assumed to be the ideal state, and attempts were made to preserve and protect the institution from disturbances which would disrupt it. New leaders, instead, must work “to prepare the school to be a creative force in a changing world” (Wallace et al., 1999, p. 26). Wallace et al. (1999) end their article by quoting both Senge (1990) and Wheatley (1992). In fact, it may be a principal’s imperative to disrupt equilibrium.

The changing school world is a dissipative structure in the language of New Science—a system which can be poised on the edge of chaos, in a readied state for the changes and adaptations that will help the school adapt and succeed. To create those changes, leaders need that new, systemic perspective that views signs of disorganization and disorder not with distress, but as “signs that the system of education is healthy and on its way to a much improved new order” (Sullivan, 1999, p. 421-422). The leader’s job is to “ride the crest” (p. 422) of such a system, understanding that no policy or plan is ever permanent. All goals are “continuously evolving” (p. 422).

#### Growing New Leaders: Developing Capacity and Increasing Participation

It is the leader’s responsibility to move the organization forward, and as a transformative leader, to bring the followership into leading roles, too. People within the organization

must learn through involvement and dialogue . . . how to maintain a successful organisation in dynamic conditions, how to establish strategic direction by making the best choice from a contingency of futures, and how to collaborate to the point of accepting a shared global vision of themselves and the world around them (Sullivan, 1999, p. 419-420).

The key understanding of the multiplicity of futures and the shared vision that will help to create the desired future is the New Science understanding of the 21<sup>st</sup> century. We need to embrace diversity of *all* kinds within our schools.

In looking at and evaluating high school principals on these criteria, whether using ISLLC standards (1996), Senge's Five Disciplines (1990), Wallace, et al.'s Framework (1999), or some other qualities list, it will always be important to remember that the categories overlap, and that a high score on any one particular behavior may not necessarily translate into overall high ratings. Some factor or set of factors may have a high correlation with positive leader evaluation in terms of the two faculties—one at a school that has changed almost continuously in the ten years since 1992, and one that has had few changes during that time. But while we are exploring differences and postulating interpretations, we also need to remember what quantum physics teaches us: “Everything depends on context, on the unique relationships available in the moment” (Wheatley, 1999, p. 173). Solutions do not necessarily transfer from one context to the other.

#### May I Have This Dance?

Our New Science principals must be leaders who are able to articulate a vision that can then be translated into significant, intended change. When this change meets the higher needs and aspirations of the followers in a school system—teachers, parents, students—the changes will ripple outward from their initiation point, engaging leaders and followers in a transformative dance, as Wheatley (1992, pp. 42-43) suggests.

Wallace, Sweatt and Acker-Hocevar (1999) build on Wheatley's metaphor to suggest that

educational leadership is dynamic and involves qualities like rhythm, flow, and direction, and the music of the dance is unique to each context. Only those who step onto the dance floor and engage with the music are in a position to assess the quality of leadership that is in progress (p. 27).

Wallace, Sweatt and Acker-Hocevar (1999) suggest the difficulties of an outside observer evaluating the quality of leadership. If the music of the dance is unique to each context,

then more important than the “absolute” qualities of leadership, if such qualities can be said to exist, is the ability to adapt to the individual dance that is in progress within each organization.

For the research project in this dissertation, the researcher asked teachers—many of whom had been out on the dance floor over a ten year period—to make some assessments of the leader and of the real and intended changes at Middletown and Edgetown High Schools, two large 9-12 high schools 30 miles from each other in northern New England. Chapter VI examines the way these schools have changed in the ten year period from 1992 to 2002, and looks at the leadership profiles of the principals—in their own words and in the words of those who had been accompanying them in the dance at each school during that time.

## CHAPTER V

### CONCEPTUAL FRAMEWORK AND METHODOLOGY

THE RESEARCH QUESTION: What are the New Science implications for school and leadership research?

“We’ve taken disturbances and fluctuations and averaged them together to give us comfortable statistics. Our training has been to look for large numbers, important trends, major variances. We live in a society that believes it can define normal and then judge everything against this fictitious standard. We struggle to smooth out differences, conform to standards, measure up. Yet in life, newness can only show up as difference. If we aren’t looking for differences, we can’t see that anything has changed; consequently, we aren’t able to respond.”

--Wheatley, 1999, p. 99-100.

Quantum physics and chaos theory, together, have profound implications for research. Accepting the paradigm shift to New Science changes research design in nonlinear systems. A study of chaotic changes in nonlinear systems has shifted us far from the rational mechanism of Newton’s mechanics in which small differences are often ignored, to the world of the Butterfly Effect—where small differences may result in huge discrepancies at some unpredictable time in the future.

New paradigm thinking has implications for research models—in terms of the concept of scientific objectivity, and in terms of applications in *social science*, *business*, and *education*. The conceptual foundation for this dissertation was laid in the first four chapters. In this chapter, New Science ways of thinking about the research process are suggested, and the specific research methodology for this study is outlined. Then the



demographics of the two communities under study, the survey development, and the limitations of the study are presented.

### Shifting Views of Reality

#### Quantum Views of Metaphysics and Methodology

The New Sciences have led to significant shifting of perspective in the scientific community on how knowledge of the world is defined and gained, and how concepts of the world are formed (Kellert, 1993, p. xiv.). Kellert (1993) reminds us that our *methodologies* are based on our beliefs about the nature and structure of the world—our *metaphysics* (p. 46). If New Science calls our methodologies into question, or points out contradictions or paradoxes in our results, the next step is to see what metaphysical beliefs must also be called into question. This is, of course, the definition of a paradigm shift.

#### Connectedness and Relationship

Under the new paradigm, cause and effect are not as simple as they used to be. David Bohm's (1957) *Causality and Chance in Modern Physics* provided a way of viewing particle relationships and understanding quantum reality that has resonated with organizational theorists. Bohm suggests that the objective nature of the world, and of reality, can best be understood using a particle in Brownian motion as an analogy: its path in motion can only be approximated (p. 168), because we can identify its nature or its location (particle or wave), but not both at once. Bohm's analysis emphasizes the *relational* in the way quantum particles are connected. They have a "reciprocal relationship" (p. 144) which helps to define them. Understanding this relationship leads to a new way of conceiving of the physical world: "the basic reality is the totality of

actually existing matter *in the process of becoming*” (p. 168, italics added). To understand the reality of any one particle, then, is to seek an understanding of all of its reciprocal relationships in a multiplicity of contexts (p. 169).

The connection to systems thinking is clear. The concepts of *connectedness* and *relationship* as well as the focus on *the process of becoming* are all familiar, as well, to practitioners of Zen and other Eastern religions. Physicist Fritjof Capra has explored the parallels between quantum concepts and Eastern religion in *The Tao of Physics* (1985). The recognition of these parallels is demonstrated in the strand of Eastern thinking that runs through much of the business management literature published in the 1990s. Bohm emphasizes the importance of holistic understanding of scientific phenomena (Senge et al., 2000, p. 563-564). The understanding, Senge believes, must be both holistic and aesthetic—otherwise, a deep understanding of a system can not be obtained.

#### Seeing the “Big Picture”

Senge et al. (2000) suggests that “analytic, scientific conceptualizers”—such as those trained at schools like the Massachusetts Institute of Technology (p. 564)—have actually held back development in systems thinking and the understanding of the ways systems change because these leaders focus on analytic minutiae and thus never see the big picture (p. 564). The language and Western tradition of analysis confines and limits our thinking, as Hayles (1991), citing Cartwright (1983) also suggests:

So strong is our belief in analysis, . . . that we take the environment to be the artifact and the collection of factors to be the reality. Thus gases are said to obey the ideal gas laws, although “correction” terms always have to be added to account for deviations of actual gases from the “ideal” behavior they are supposed to follow. The laws of physics are not laws at all, Cartwright concludes. Instead they are simplifications that reflect how we

divide up and analyze systems. We forget that reality is not these laws, just as we forget that most physical laws do not accurately describe the complexities of real situations (p. 16-17).

Similarly, Senge suggests that if a leader engages in the analytical approach of breaking a system into its parts, he or she may miss its “coming into being” and thus may miss the most important cues of all if he or she is going to play a role in directing or guiding the change process. Effective leaders who are going to “ride the wave” in their organizations need to be able to “shift from the abstract conceptual world to the concrete world” and back again, with ease.

#### New Metaphors for New Reality

Physicists may have the option of retreating to the math when language becomes too imprecise to describe scientific reality, as Heisenberg (1958, p. 179) suggests; the rest of us need to shift gears: or rather, we need to replace mechanistic metaphors such as “shifting gears” with new metaphors: “embracing a vision,” “going with the flow,” “riding the waves.” A shift in the language and metaphors—from the clockworks of the Newtonians to the whirlpool, or waterfall, of the chaos theorists, as Hayles (1991, p. 8) suggests—can help to remind us of the new concept of reality, which like the unstructured flow of water is “turbulent, unpredictable, irregular, and infinitely varying in form” (p. 8).

#### Quantitative Research Methodology

##### Quantitative Research in Nonlinear Systems

Quantitative research models used to study nonlinear systems violate the quantum understanding of reality as a complex relational system. Quantitative research statistics are designed for systems in which linear relationships—rather than nonlinear—apply. In

the Newtonian way of thinking (the old paradigm), cause and effect is a linear process: we assume that we can tease out the causes of whatever effects we observe by “controlling” whatever variables we can. The quantitative research process typically looks at one variable at a time and strives to eliminate extraneous factors to make cause and effect simpler to study, *all other factors being equal*.

The New Science paradigm suggests that this belief is mistaken because of two false assumptions:

1. that *single* causes can be identified and controlled, and
2. that the experimenter can stand outside of the experiment as an observer, without altering the results.

New Science suggests, instead, that the web of interrelationships and causes and effects is so complex that to believe we can “control” any variable is a mistake; and experiments in particle physics have made it clear that the experimenter clearly influences the results of the experiment: what she looks for is what she gets.

Researchers in social sciences (Gregersen and Sailer [1993]; Smith [1995]; Warren et al. [1998]), organizational management (Senge [1990]; Wheatley [1992]; Priesmeyer [1992]; Begun [1994]), and education (Runkel [1990]; Cziko [1992]) have considered ways in which New Science paradigms affect research methodologies in those fields.

Gregersen and Sailer’s (1993) article is especially instructive in detailing the ways in which chaos theory (in addition to quantum uncertainty) can affect research methodology in the social sciences. They use the term “transformational systems” (p. 780) for the nonlinear systems for which such study is appropriate in order to avoid the

multiple connotations of “chaotic systems” and to emphasize the key element of dynamic change as it affects these systems (p. 780).

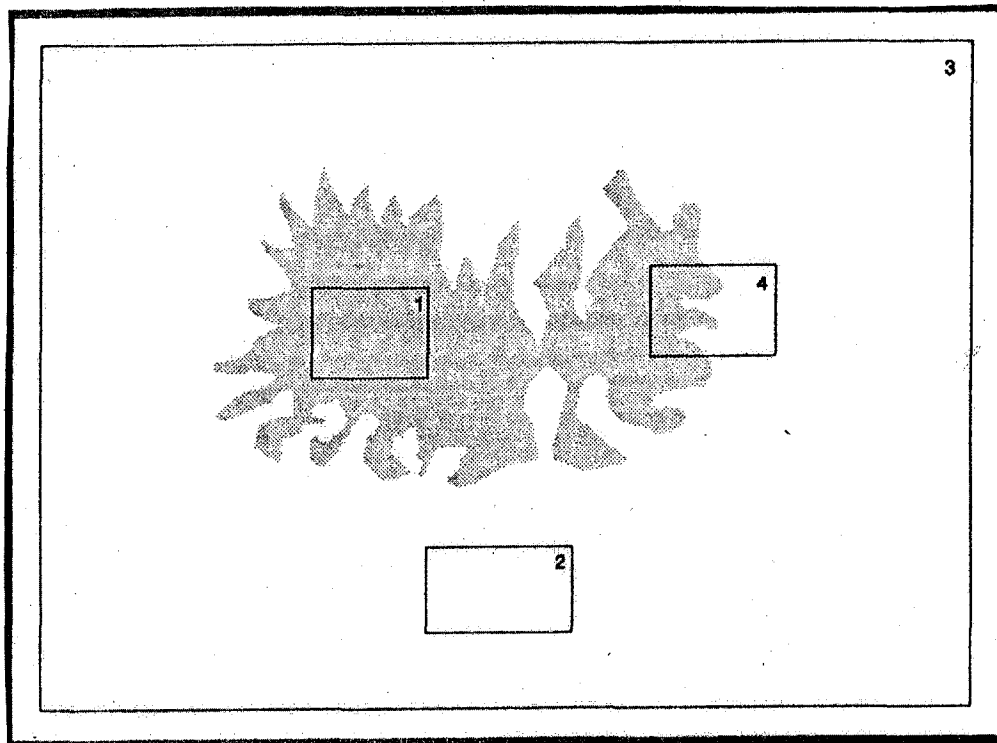
By examining visual representations of Mandelbrot’s Set (perhaps the best known representation of nonlinear equations), Gregersen and Sailer (1993) conclude that traditional tools of mathematics designed for continuous, “normal” distributions must be inadequate when dealing with “such discontinuous patterns of behavior” (p. 785). Trying to use traditional statistical measures such as analysis of variance and regression analysis on such data may actually be misleading, “produc[ing] an illusion of certainty (i.e., prediction) for a social phenomenon with underlying unpredictability” (p. 786).

Thus chaos theory (as well as quantum notions of reality) challenges our traditional notions of cause and effect, on which much control group research is based, because in dynamical (nonlinear) systems, prediction is impossible because of the unpredictability of the butterfly effect. Statistical methods are most useful when data sets fall into normal curves, but that does not happen with sets which represent nonlinear equations.

Gergerson and Sailer (1993) present a figure representing four hypothetical studies of a chaotic system, reproduced as Figure 5.1 (below). The authors illustrate their argument using  $x$  to represent marketing and  $y$  for production (p. 787). For the purposes of this discussion, educational variables will be substituted in their argument. It is worth examining this model closely.

Figure 5.1

## An Illustration of Limitations in Quantitative Study of a Nonlinear System



--Reproduced from p. 795 of Gergersen, H. and Sailer, L. (1993). Chaos theory and its implications for social science research. *Human Relations*, 46, 777-802. Used with permission.

Study 4 looks at the “boundary between divergence and nondivergence” (p. 795).

This study examines the border where change takes place, but Gergersen and Sailer (1993) emphasize that improving measurement technique, adding subjects, or using more sophisticated statistical analyses will do nothing to improve prediction in Study 4; “in fact, it may even make things worse. Crude techniques will likely miss the fine chaotic structure generated by the process” (p. 796), while measurement over time would only be able to identify diverging individuals *after* they had diverged or not diverged.

To cope with this dilemma, Gregersen and Sailer (1993) propose a strategy for setting up an experiment. Examine the population one wishes to study to determine whether it has these qualities:

7. a transformation system [that is, a nonlinear system with chaotic structure],
  - entity states,
  - external environments, and
  - nonlinear iterations (i.e., “current states dependent upon previous states” [p. 796]).

The researcher must next determine whether the sample is chosen from the part of the system which diverges or does not diverge; or from the “inherently chaotic” edge (p. 796). If, for example, the problem is represented by data within either Box 1 or Box 2 in Figure 5.1, traditional statistical analyses may yield useful results. If the data points fall within Box 3 or Box 4, the researcher can not hope for statistical significance.

#### Levels of Significance in Educational Research

Gregersen and Sailer’s Four Hypothetical Studies of a Chaotic System (1993) reminds us of one further problem: an initial investigation which uncovers the underlying parameters of the sample population, as Figure 5.1 does, may not be possible or feasible. Thus researchers may blindly rely on statistical approaches to sample selection and may thus be puzzled or frustrated by low significance ( $r^2$ ) in study results.

Cziko (1992) points out several of the problems that have been caused by an overemphasis in educational research on traditional quantitative statistical models with their reliance on making predictions with statistical significance accepted with correlation coefficients of .5, with  $p$  less than .05 or .01, only accounting for “one quarter of the total

group variance under study” (p. 11). Such data is even less useful, Cziko (1992) asserts, when attempting to predict individual scores.

A correlation coefficient of .50 is actually 86% *useless* for making predictions about individuals. Worse still, such a correlation will most likely be *more* than 86% useless for making predictions about individuals *not* included in the original research sample, and this is the only context in which it makes sense to make such predictions since the values of *Y* for individuals in the original research sample are already known (p. 11).

Thus, despite the poor prediction of individual scores possible with such data, Cziko cites studies which indicate that .50 is generally a larger bivariate correlation coefficient than is typically found in educational research studies (p. 11).

Similarly, Cziko (1992) points out that although assessing group differences using effect sizes of .50 is common in educational research (which would indicate a difference between two group means of one half the standard deviation), “such a difference actually indicates more overlap than distinctness between the two groups” (p. 11). His analysis makes clear the hazards of depending on quantitative research designs to determine best practice in instruction. Any measures taken to “control” or match groups are going to be inadequate to define the complexity of the learner and the learning task, and the notion of “control” is an illusion.

Nevertheless, that illusion is difficult to dislodge. Wheatley (1999) suggests that social scientists are still pursuing quantitative research because of what William Bygrave called “physics envy” (p. 160). Ironically,

. . . we social scientists strain for respectability, using the methodologies and thought patterns of seventeenth century science [Newton’s laws of motion], while the scientists. . . are moving into a universe that calls for entirely new ways of understanding” (p. 160).



Quantitative research designs with controlled variables are based on the assumptions mentioned above—that single variables can be controlled and that the experimenter’s effect is minimal—yet the New Science paradigm suggests that all other factors *never are* nor *ever can* be equal. More fruitful procedures are those which consider factors in all their messy, chaotic interrelationships. The New Science paradigm provides the theoretical basis for justifying and embracing the use of qualitative models—or qualitative models in combination with quantitative—focusing on the particular system *as it exists* rather than trying to eliminate or control factors, and seeking to *understand* rather than to *predict* behaviors.

#### The Influence of the Experimenter in Determining System Parameters

The process of making sufficient observations to determine the parameters of the system may itself have an effect on the system one is trying to study. That point has been made also by quantum physics: set up your experiment to detect waves and you will see waves; set up your equipment for particles and you will see particles. The scientist/observer influences each experiment. Gergerson and Sailer (1993) suggest that to determine the parameters of such systems would require “at least 1000 points in time for every entity to the system, and perhaps 100 such systems would need to be studied” (p. 787). They conclude that realistically, finding affordable ways to collect data (in longitudinal, synchronic studies) would require thousands of observations in order to discern possible patterns (p. 793). Collecting data on such a massive scale is practically impossible in school settings—indeed, in most social science settings.

## New Quantitative Methods to Record Change Over Time

In the field of business management, the data of many observations is more readily available. Priesmeyer (1992) has taken the phase planes of Lorenz' weather patterns (See Chapter 3, Figure 3.3, page 77) and suggested new ways to record data that will take change over time into consideration.

A value of Priesmeyer's work to other fields is the care with which he examines and criticizes typical normative statistical practices, and then proposes alternative analyses which take chaos theory into account. For example, Priesmeyer (1992) notes that histograms and scatter diagrams are *not* appropriate visual representations of data sets that involve time, because "they mask important patterns of behavior that may be necessary to control the system they describe" (p. 151). Scatter diagrams are used in regression analysis, in which a line or curve is fitted to the patterns on an x/y axis formed by the paired observations of the two variables being studied. Chronological patterns in the data must be ignored or excluded in doing this type of analysis; so using such charts is inadequate, Priesmeyer concludes, for any data that include measures over time (p. 151).

Instead, Priesmeyer (1992) proposes ways to use and interpret phase planes and marginal history charts—two graphic representations of business data plotted over time—to contribute to decision-making in all aspects of business: from marketing, finance, and production to management of human resources.

An understanding of systems that includes chaos and complexity theory must change the way scientists research those systems (Begun, 1994, p. 329). Rather than trying to isolate single variables and their effects, the relationship among variables and

how they change over time needs to become the appropriate focus of study (Begun, 1994, p. 329).

#### The Effect of the Observer and the Leader on the Experiment

In studying social systems where the researcher is trying not to disturb natural patterns, experimenter effect is an important concern. In education, (and in business management, as well) there are specific goals: if the process of the researcher results in *more* learning for the subjects (or greater profitability for the company), that's what it's all about. The role of the experimenter, teacher, or principal within an educational system *is* to effect change. In that respect, we need to worry less about experimenter effects than might an anthropologist attempting to study a culture in situ. School goals may thus be stated: school people wish to advance student learning within the system in order to teach and learn with the greatest possible efficiency and with the least possible anxiety and disruption among the members of our learning community. Effort, risk, and even some pain are sometimes required in the processes of learning. The goal becomes to effect change in a positive way, and strengthen *all* parts of the system, so that everyone understands the goals and the processes of change and everyone is resilient enough to stand the process in reaching towards the goals.

#### Motivation: Perceptual Control Theory

One of the key ways in which schools and organizations differ from experiments with quantum particles is the concept of human choice and will. Thus school leaders must always consider the role of human motivation in schools. Motivation—the desire of students or principals or teachers to accomplish certain tasks and the actions they make to accomplish those ends—are always a central factor in the process of education. Cziko

(1992), in answering the critics of his earlier article (1989), reiterates his view that group-statistics-based quantitative research not only has added little to the understanding and improvement of education, but also that the cause-and-effect model on which most of that research is based “cannot account for complex, purposeful human behavior” (p. 17).

Complex, purposeful human behavior can be accounted for in terms of motivation.

For Cziko (1992) and Runkel (1990), Perceptual Control Theory (Powers, 1973, 1989, 1990a, 1990b) provides a theoretical construct to explain the role of human motivation in decision-making. The implications of this psychological theory—although beyond the scope of this dissertation—are vast for the study of education at all levels. In brief, perceptual control theory (PCT) provides a model for understanding purposive human behavior. The behavior may certainly be influenced by the environment, but it is always “a function of what it senses (or what a living organism perceives) *compared with its internal goal or reference level* (which itself can change over time)” (Cziko, 1992, p. 15). Runkel (1990) gives an excellent explanation of how PCT plays a role in understanding the change process in schools.

In education, we call this internal goal or reference level *motivation*. Business leaders call it *shared vision*. In schools, when the teachers and students share the goals of the administrator, change happens—sometimes very quickly.

Once again, the problem, as Cziko (1992) points out, is that PCT traces the results of an individual over time, and it takes many repeated measures to generate the data. Cziko (1992) suggests that quantitative statistical procedures thus might be useful for survey research, but not with the goal of learning something about individual students,

teachers, or administrators (p. 17). To collect those data, one must rely on qualitative methods.

### Implications for School Administration

Administrators in a high school who understand the New Science paradigm know that the world is a changeable place. In addition to understanding the complexity of the systems that make up schools, principals must be alert to the nuances—the small things: the flapping of the butterflies' wings. Ignoring those nuances is another way in which an over-reliance on quantitative methods has skewed our perspectives, as Wheatley (1999) suggests in the quotation which heads this chapter. Wheatley reminds us that looking at and considering only the almighty average, the normal curve, the “large numbers, important trends, major variances” (p. 99) may prevent us from observing and responding to the tiny variations that will gain significance on another day.

The exercise of leadership in school systems is certainly a continuous and periodic process that will be more successful and less stressful when the leader understands the situation from a New Science perspective. Schools—like business organizations—are nonlinear systems. In education, we need researchers who can mine Priesmeyer's (1992) business methods for their educational applications. Then researchers can begin to collect data on change processes using methods that make sense for nonlinear, unpredictable systems, like schools; and then we can develop strategies and profiles of leadership that will foster and support necessary change.

From Conceptual to Empirical: Translating the Concepts of New Science into an Empirical Study

The previous discussion has suggested in broad strokes some ways in which the implications of a new paradigm in science should influence aspects of educational

research. Individual researchers considering the new science paradigm face a practical dilemma, as suggested by the social science and business writers mentioned earlier in this chapter: how can a study of *all* of a system and its many interrelationships over time be completed in a reasonable period? This basic question has many possible corollaries. How can a district evaluate its curriculum and instructional programs in a timely fashion and make decisions that will advance student learning? How can principals and other administrators evaluate their effectiveness as leaders and modify their style or actions to facilitate greater growth and learning among faculty and the students in their charge? What role should strategic planning play in a quantum universe? How can a doctoral student with finite time and resources design a study that will shed some light on all or any of these questions?

A key factor is time. This researcher wishes to study change in a school district over a ten-year period and its relationship to teachers' perceptions of leadership styles of principals. One way would be to survey the faculty annually, asking for their evaluations of the principal, and collecting and comparing the data year-by-year. Such a process would surely have practical feedback benefits: it could provide annual feedback to the principal on his or her performance as viewed by faculty as a whole, as well as providing individual responses which could be tracked over time. The drawback, of course, is that the study would take ten years—a long time in the life of any researcher, and beyond the limits of what is possible in most Ph.D. programs.

In most school systems, the principal needs faster feedback in order to facilitate change. If it takes a year for the researcher to get back to the principal with feedback on

the faculty survey, the opportunity to respond to most concerns and criticisms has already passed by.

In addition, the question of change in a school system and the relationship of that change to the leadership style of the principal requires that one take a longer view and ask how has the system changed over time and what influence did the leadership style of the principal have on the changes that took place?

In order to shed light on some of these questions, this study sampled opinions of faculty during 2002, who had observed their principal(s) over or during the ten-year time period, asking faculty to evaluate the principals' leadership retrospectively.

### Research Methodology and Demographics in this Study

#### Overview

In order to take the long view of the change process, two schools were selected with contrasting amounts of change over the ten-year period from 1992 to 2002.

Edgetown (where the researcher is employed as a teacher) has undergone significant, substantial change in ten years; by contrast, Middletown is a school that has essentially maintained the same basic organizational and curricular features in the same period of time. Each school, coincidentally, has had three principals in that ten-year period.

The researcher built a profile of the changes within each school in the ten-year period from 1992 to 2002. All of the data were collected in 1992. In their interviews and surveys, principals and faculty agreed on their reports of changes at the schools. Archival research into school records, town reports, and principals' and superintendents' annual summaries which appear in the town reports were used to confirm the changes mentioned in the surveys and interviews.

One of the ways to examine relationships is by using combinations of quantitative and qualitative approaches. The survey responses were analyzed quantitatively, but some of the survey questions also called for qualitative assessments and opinions, as well as Likert-scaled judgments on leadership factors.

The researcher also interviewed six veteran teachers from each school, seeking their assessments of the principals, in order to build profiles of leadership styles for each of the five principals (one principal served at both schools, serving Edgetown as principal for fifteen years, and serving Middletown as interim principal for one year).

The researcher also conducted audio-taped interviews with each of the principals, asking them questions about their leadership strategies during their respective tenures within the ten-year period of study. Each principal rated himself or herself on the same scale the faculty had used to rate the principal.

The interview data were valuable in confirming stylistic differences in leadership among the principals discussed—confirming, for the most part, the data gathered in the leadership assessment part of the teacher survey.

#### Demographics

##### Edgetown and Middletown High Schools

The two high schools in this study—are both Class L (large) schools, as ranked by the New Hampshire Interscholastic Athletic Association for athletic competition.

Middletown is larger by 505 students—with a June, 2002, population of 1,520 compared to Edgetown's June school population of 1,025.



Both schools are made up of students in grades 9-12 in towns with one comprehensive high school, and are located in the southern tier of New Hampshire, about thirty miles apart from each other.

Coincidentally, each school had three principals in the ten-year period covered by the study, making for interesting points of comparison. It was also a coincidence that Principal Marple retired from Edgetown in July of 1996, and went to the interim principalship at Middletown in September, 1996, for the 1996-1997 school year. This overlap provided a way to compare two different faculties' views of the same principal-leader.

The communities of Edgetown and Middletown have both been part of a growing population base that has necessitated renovations and additions at each school in the past ten years. Middletown's building project—completed in 2002—added a three-story addition with eleven regular classrooms, six new science labs, and a new school/community TV studio. In June of 2002, Edgetown was halfway through a two-year renovation plan that added a new cafeteria, expanded gym, new central office space, six renovated science labs and classroom space; in addition all parts of the building were “refreshed” and updated, with deficient areas brought up to code. Renovations were scheduled for completion by the end of 2003. These school renovation projects, of course, represent a significant change in school conditions, and are one of the “changes” often cited on the surveys of teachers and principals.

Both communities have had similar relationships with the taxpayers/voters in their towns. The towns both voted in 1996 to follow the budget process established in New Hampshire Senate Bill 2, which changed the procedure for town approval of budgets for

school and town government. School budgets and bond issues are no longer decided by town meeting, but are now part of a ballot vote at the polls. During the hard times of economic recession during the mid-1990s, both communities turned down school budgets and school bond issues. Dates of school budget defeats are included in the chart of changes in Figure 5.2, below.

#### Change at Edgetown and Middletown High Schools

In this section we will look at evidence of change at Edgetown and Middletown High Schools. In considering change we want to avoid the assumption that all change is good. Nevertheless, it has been clear that the world is changing more and more rapidly, and that the pace of that change continues to increase. For example, in the ten years from 1992 to 2002, both Edgetown and Middletown underwent a revolution in the addition and integration of computers and other new technology applications in the schools. Nevertheless, although the two schools are similar in geographical location, size, renovation projects, and taxpayer support, they are quite different in patterns of change and educational reform. During the period from 1992-2002, Edgetown changed significantly in organization of classes, grouping of students, administrative structure, and staff development and recertification. In the same period, Middletown maintained a consistent, traditional program of education and organization. This study was designed to investigate the ways in which principals' leadership may have influenced, or not influenced, substantive change (or lack of it) at the two schools.

Figure 5.2

## Timeline for Edgetown and Middletown, 1992-2002

YEAR	EDGETOWN	MIDDLETOWN
1992-1993	<p>--Begin 9<sup>th</sup> Grade Core Program. --Blueprint for Student Success (SAU initiative to embrace inquiry and critical skills development)</p> <p><i>Passed: School Budget.</i></p>	<p>--8-period day instituted.</p> <p><i>Passed: School Budget.</i></p>
1993-1994	<p>--Begin 10<sup>th</sup> Grade Core Program. --Begin Critical Skills Training for faculty in August, 1993.</p> <p><i>3 Teenage suicides shake the high school &amp; the community.</i></p> <p><i>Defeated: Oct., 1993—Negotiated Teacher Contract</i></p> <p><i>Defeated: March, 1994—Negotiated Teacher Contract</i></p>	<p><i>Defeated at School District Meeting: Jefferson Plan.</i></p> <p><i>Defeated: School budget.</i></p> <p><i>Delayed: Health Curriculum</i></p>
1994-1995	<p><i>Passed: March, 1995—Negotiated Teacher and Support Staff Contracts.</i></p>	<p><i>Passed: School budget.</i></p>
1995-1996	<p>--Edgetown joins NH Alliance for Effective Schools and the School Improvement Process</p> <p><i>Edgetown adopts SENATE BILL 2 for voting on town &amp; school budgets.</i></p>	<p><i>Passed: School budget.</i></p> <p><i>Passed: Bond issue for new cafeteria addition, to be completed for full use in 1997-1998.</i></p>
1996-1997	<p>--NEASC puts Edgetown on warning status.</p> <p>--School to Career program with NH grant of \$240,000.</p> <p>--AP courses added in English, biology, chemistry, calculus, and history.</p> <p><i>Defeated: School budget.</i></p> <p><i>Defeated: Proposed high school renovation.</i></p>	<p><i>Middletown adopts SENATE BILL 2 for voting on town &amp; school budgets.</i></p> <p><i>Defeated: School budget.</i></p> <p><i>Defeated: Teacher and Support staff contracts.</i></p>

1997-1998	<p><i>Defeated: School Budget.</i>  <i>Defeated: Proposed high school renovation.</i>  <i>Defeated: Teacher Contract</i></p>	<p><i>Passed: School budget.</i>  <i>Defeated: Bond issue for proposed high school addition.</i>  <i>Passed: Teacher and Support Staff Contracts by special ballot in Dec., 1997.</i></p>
1998-1999	<p>--Edgetown selected for Best Schools I state grant to re-structure the high school.  --NEASC warning status removed.</p> <p><i>Defeated: School budget.</i>  <i>Defeated: Teacher contract.</i></p>	<p><i>Defeated: Bond issue for proposed high school addition.</i>  <i>Defeated: Oct., 1999, proposal to accept state funding from the Adequacy grant to pay interest on the school addition.</i></p>
1999-2000	<p>--Best Schools I continues.  --Best Schools II grant is awarded for implementation of the integrated model for advancing student learning (professional development).  --Begin new SAU professional development plan for advancing student learning.</p> <p><i>Passed: School budget.</i>  <i>Passed: 5-year teacher contract.</i>  <i>Passed: Proposed high school renovation @ \$11,995,000.</i></p>	<p>--Begin modified block schedule.  --Begin high school renovation project.</p> <p><i>Passed: School budget &amp; all other school articles.</i>  <i>Passed: Bond issue to start proposed high school addition.</i></p>
2000-2001	<p>--Begin block scheduling for all grades.  --Begin high school renovation project.</p> <p><i>Passed: School budget.</i></p>	<p>--NEASC Re-accreditation visit.</p> <p><i>Passed: School budget.</i></p>
2001-2002	<p>--Gateway [sophomore project/competency] and Star [senior project] are developed, piloted, but not yet implemented.</p> <p><i>Defeated: School budget.</i>  <i>Defeated: Proposed Kindergarten study.</i></p>	<p>--Three-story high school addition completed.</p>

From 1990 to 1994, both schools were led by good principals who were aware of current best practices research. Joe Marple at Edgetown had continued his education past

his master's degree and had close connections with people in the New Hampshire State Department of Education; Bud Tate of Middletown had close associations with the New England Association of Schools and Colleges (NEASC). Both principals were involved in suggesting curriculum and instructional reforms at their respective schools. In Edgetown, change happened; in Middletown, reform failed. Was this a failure of leadership, a result of the setting, or a combination of factors? This retrospective analysis attempts to uncover some understanding of the interaction between the change process and the leadership at the principal level of these two schools during the period of study.

The table in Figure 5.2 indicates changes instituted at each school in the ten-year period of study, 1992-2002. Passage or defeat of the annual operating budget and school bond issues is also included.

Change at Edgetown. Edgetown's preparation for change began in 1990, under the administration of Joe Marple, with the school joining the state-sponsored School Improvement Program (SIP), which was a state initiative to develop a collaborative method of school reform involving all stakeholders. In a cost-cutting move which was to have long-term effects, the positions of department heads were abolished in that same year.

In 1992, Edgetown began a heterogeneously-grouped core team teaching program with the ninth grade. All ninth-grade students were heterogeneously grouped in science, English, and social studies. Ability groupings were maintained in math, but the math teacher was a part of the core team of teachers. All eighty students assigned to a team had the same four core teachers. Each core teacher taught four classes of approximately twenty students each, plus one other elective class "outside of the core." The following

year, core teams were formed for tenth grade, as well, using a similar pattern. Economics or health (each one a semester course), English, biology, and geometry were the core subjects, and again, an effort was made to maintain heterogeneity in grouping of students for instruction, except in math, where students could take geometry or “geometry with proof”—the more demanding course.

Efforts were made to block students in eleventh grade courses of American literature and American history, so that “American Studies” team-teaching could take place at that level, too. Scheduling problems prevented this teaming attempt from being completely successful.

In 1995, the high school joined the New Hampshire Alliance for Effective Schools; the central Office initiated training in Critical Skills (project-based learning) for all teachers in the district. Teachers were paid to attend the full-time, two-week summer training program. Although not all teachers participated in the training, most did. The training was offered for three consecutive years and all teachers in the SAU were encouraged to participate.

In the spring of 1996, when the New England Association of Schools and Colleges (NEASC) re-accreditation team visited Edgetown, the school was commended for its innovative core team program for the ninth and tenth grade, but placed on warning for the lack of coordination in the curriculum, and for certain deficiencies in the building and facilities. An intense effort to standardize curriculum across teachers and to align curriculum with state standards was initiated and completed in the next three years.

In the meantime, Dr. Doran Hansen was hired as the new Edgetown superintendent after three years in a holding pattern with interim Superintendent Hubert

Smith. Hansen had a background in curriculum and budget, and keen political skills which helped him to win a five-year teacher contract and a town vote for badly-needed high school renovations.

With the support of another Best Schools grant, a team of teachers and administrators—including Dr. Hansen—re-designed the professional development plan, eliminating clockhours for teacher recertification, and integrating the recertification process with supervision and evaluation. The new plan began implementation in 1999-2000.

Within the core teams at the high school, teacher empowerment increased. Teachers were encouraged to work on collaborative, cross-disciplinary projects, and the Critical Skills training supported the development of “real-world” projects. Without department heads, there were few obstacles or limits to provide either challenge or guidance. Time for the ninth and tenth grade classes was blocked in the schedule, and teachers were encouraged to make use of the time as it suited the projects or teaching being done: some ninth and tenth grade teachers experimented with A and B-day blocked time schedules. These teachers later served as advocates when the school began to consider schedule changes which would incorporate blocked time for all classes. The change to an 8-period blocked schedule took place in September, 2000, after a year of research and investigation—funded and supported by state “Best Schools” grants—in which all faculty participated in school visits to schools with “exemplary practices.”

The year 2000 brought another new principal, Adam Stein, to Edgetown, with a commitment to risk-taking and growth as primary values.

Change at Middletown. In that same ten-year time period, Middletown adopted one significant change: a change of schedule to a modified block schedule, which began in the 1999-2000 school year. Middletown is a great example of a traditional school doing the traditional thing very well. It runs with tracked classes from grades nine through twelve. Department Heads' duties are a clearly defined and well-accepted part of the hierarchical structure of the school. Superintendent Justin O'Brien was well-respected for his administrative skills, both within the district and outside of it. Except for that change to a modified block, the curriculum, program, and grouping for instruction has remained essentially the same.

According to his own account, which was supported by the teacher interviews, Principal Tate of Middletown tried to initiate changes in the early 1990s, but was stymied by two things: one was a conservative school board that blocked all but the most traditional suggestions; the other was the success of the school as it was. Because the students were successful—the drop-out rate was low, daily attendance was excellent, and the per cent of students attending post-secondary institutions was relatively high—there was little incentive to institute changes.

#### Tenures of Principals and Superintendents

Tenures of Principals. In the ten-year period from 1992-2002, Edgetown and Middletown each had three principals, as indicated in the table in Figure 5.3. Total years of service at the school follow each name.



Figure 5.3

## Tenures of Edgetown and Middletown Principals, 1992-2000

	EDGETOWN:			MIDDLETOWN:		
	<u>Name</u>	<u>Years of Tenure</u>	<u>#yrs</u>	<u>Name</u>	<u>Years of Tenure</u>	<u>#yrs.</u>
<b>Principal 1</b>	Joe Marple	1981-1996	15	Bud Tate	1988-1997	9
<b>Principal 2</b>	Frank Fabrizzi	1996-2000	4	Joe Marple	1997-1998	1
<b>Principal 3</b>	Adam Stein	2000-2004	4*	Val Goode	1998-2002	4

\*Stein had served two years at the time of the study.

Principal 1 at each school had a long tenure: fifteen years for Marple and nine years for Tate. Both were in position long enough to initiate change and follow through with those changes. Joe Marple retired from Edgetown and took a one-year position as interim principal after Bud Tate left to go to a larger city school. Frank Fabrizzi and Val Goode each had 4 years as principal. Goode left in August, 2002, to take a principalship out of state. Adam Stein had just completed his second year as principal in June of 2002, when the Edgetown faculty were surveyed. He continued in that position until 2004, two years beyond the period under study.

Tenures of Superintendents. Changes in focus and direction of a school may be initiated from the Superintendent's level, so in considering the impact of leadership on change, it is relevant to consider the superintendent's tenure in relationship to the principal's. In Edgetown, the turnover in the Superintendent's position has been relatively rapid, although a little longer than the national average of two years. In Middletown, by contrast, there had been great stability in the superintendent's position, with Justin O'Brien having an especially long tenure in the district, starting as an

assistant superintendent in 1975, and holding the superintendent's position for thirteen years (since 1988) until his retirement in June of 2001, when Margret Joplin took the helm.

Figure 5.4 shows the Timeline of Principals' and Superintendents' terms at Edgetown and Middletown, from 1992 to 2002. The vertical arrows indicate continuity: in 1992, for example, all the principals and superintendents had been on the job the previous year, so arrows are listed above their names. At the bottom of the chart, one can see that Val Goode's tenure ended in 2002, but Margret Joplin's began, and continued into the next year. During this ten-year period, if we consider the principal and the superintendent together as possible change agents, we see that Edgetown has had more turnover in the superintendency, with changes at three-year intervals, whereas the Middletown top leadership remained stable for nine years, until Justin O'Brien retired.

#### Methods of Data Collection

Multiple methods of data collection were used to collect information about the changes at the school, the patterns of leadership exhibited by the principals, and the teachers' attitudes toward change.

#### Faculty and Principal Survey

A survey was developed to get data from teachers and principals. The teachers took the survey alone, with paper and pencil, and returned it to the researcher when they were done. The surveys for Middletown and Edgetown were identical, except for the high school name.

Figure 5.4

Timeline, 1992-2002:  
Tenures of Edgetown and Middletown Principals and Superintendents

School yr.	Edgetown Principal	Edgetown Superintendent	Middletown Principal	Middletown Superintendent
	↓	↓	↓	↓
<b>1992-1993</b>	Joe Marple	Barton Denver	Bud Tate	Justin O'Brien
<b>1993-1994</b>	↓	↓	↓	↓
<b>1994-1995</b>	↓	↓	↓	↓
<b>1995-1996</b>	↓	Hubert Smith (interim)	↓	↓
<b>1996-1997</b>	Frank Fabrizzi	↓	↓	↓
<b>1997-1998</b>	↓	↓	Joe Marple (interim)	↓
<b>1998-1999</b>	↓	Doran Hansen	Val Goode	↓
<b>1999-2000</b>	↓	↓	↓	↓
<b>2000-2001</b>	Adam Stein	↓	↓	↓
<b>2001-2002</b>	↓	↓	↓	Margret Joplin
	↓	↓		↓

Questions were also asked to determine the respondent's attitude toward change.

Change in a school was defined on the survey as a process that can be indicated by personnel turnover, schedule or structural shifts, curriculum revision/renewal, faculty behaviors and attitudes, and/or student behaviors and attitudes.

The Change Line in the survey was adapted from the Journey Line, copyrighted 1997 by Tichy-Cohen Associates, used with permission. It provided teachers with an opportunity to visualize the ten-year period of the study and to identify important changes in that block of time. A copy of the survey is in Appendix C.

Leadership Survey Development. The qualities rated in the leadership evaluation part of the survey were developed from Senge's five disciplines (1990)—Personal Mastery, Mental Models, Vision, Team Learning, and Systems Thinking—interpreting the items in terms of school leadership behaviors which could be identified and recognized by teachers. These behaviors were suggested by Interstate School Leaders Licensure Consortium (ISLLC) standards, as discussed in Chapter IV on leadership. This consortium of state officials in charge of certification for administrators in each state published their *Standards for School Leaders* in 1996. In addition, a special section on Collaboration was added to the survey; and People Skills was added to cover areas traditionally valued in school leaders.

A “New Science” model of leadership differs from traditional concepts in several ways. For example, in an interconnected world, a commonly accepted leadership trait like “decisiveness” may be called into question. Effective leaders may reflect upon various situations and decide that *different*, rather than *consistent* responses are called for. Leaders who understand the implications of chaos theory and *sensitive dependence on minute changes in initial conditions* are alert to the nuances of individual situations and thus may give slightly different responses rather than striving for consistency from case to case. Some teachers may fault principals for indecisiveness or inconsistency; others may recognize at least some of the complexities under consideration. An attempt was made to shape items that would get at some of these issues.

The survey items are listed in categories, below, in Figure 5.5. Thirty-two items were developed to measure the seven variables. The numbers on each item are the

numbers used in the teacher survey. The numbers were randomly assigned to the 32 survey items.

Figure 5.5

### Survey Items by Leadership Factors

#### PERSONAL MASTERY

- 3. The principal values special skills and mastery in himself and in others.
- 20. The principal inspires others to higher levels of performance.
- 21. The principal pursues his own interests and seeks knowledge in depth.
- 23. The principal is intellectually curious.
- 27. The principal demonstrates a personal and professional code of ethics.

#### MENTAL MODELS

- 2. The principal is open-minded.
- 7. The principal willingly listens to the ideas of others.
- 11. The principal encourages and suggests various points of view.

#### VISION

- 4. The principal acts on principles to improve the school and the education of students.
- 8. The principal demonstrates a clear vision for the students and the school.
- 12. The principal effectively communicates the vision and mission of the school.
- 18. The principal demonstrates his personal values in the decisions he makes.

#### TEAM LEARNING

- 9. The principal seeks information from parents and students.
- 10. The principal makes communication with the larger community a priority.
- 14. The principal works well with groups and teams.

#### SYSTEMS THINKING/DECISION-MAKING

- 5. The principal manages crises with quick decision-making.
- 13. The principal rarely makes a snap decision.
- 17. The principal considers long-range effects of his decisions.
- 24. The principal often decides based on the opinions of those to whom he has last spoken.
- 26. The principal is firm in sticking to his decisions.
- 30. The principal practices reflection as a way to understand the education process.
- 31. The principal resolves problems in a timely manner.

Figure 5.5 (continued)

## COLLABORATION

15. The principal incorporates input from outside the school (from parents and central office administrators) and weaves it into his plans for the school.
16. The principal encourages teachers to take responsibility and leadership.
25. The principal supports structures that allow teachers to lead.
28. The principal encourages and values teacher input.
29. The principal understands and deals effectively with social and political dynamics.

## PEOPLE SKILLS

1. The principal recognizes and celebrates student and staff accomplishments.
6. The principal treats people fairly, equitably, and with dignity and respect.
19. The principal trusts people and their judgment.
22. The principal protects the rights and confidentiality of students and staff.
32. The principal coaches teachers, offering critical suggestions or comments when needed.

The survey was reviewed for content validity by the experienced principal of a large middle school in Edgetown who also serves with the New Hampshire Association of Secondary School Principals, and who worked on the development and integration of the ISLLC standards for principals. As a pilot study, the survey was individually administered to four Edgetown teachers who had recently taught at the school but had either retired or moved to a different school.

Reliability coefficients were calculated using Cronbach's Alpha. Acceptable ranges for reliability of constructs using this measure is usually  $>.80$ . Because some of the Principals at Middletown had relatively small numbers of respondents, ratings of Principal 3 at Edgetown and Middletown (Stein and Goode) were combined to calculate reliability. In that category, alphas *Reliability* ranged from .81 to .91. Figure 5.6 shows the correlation coefficients for each of the seven factors examined in the survey. One item, "Rarely makes snap decisions" was omitted from the analysis of the Systems

Thinking category in order to improve the Alpha. All subsequent calculations reflect that deletion.

Figure 5.6

Reliability Coefficients:  
Principal Stein of Edgetown and Principal Goode of Middletown

Leadership Factor	Number of Respondents	Cronbach's Correlation Coefficient (Alpha)
Systems Thinking	35	.83
<i>Mental Models</i>	63	.90
Vision	59	.89
Team Learning	56	.81
Personal Mastery	47	.83
Collaboration	55	.91
People Skills	52	.83

Reliability coefficients were also calculated for each factor for each of the individual principals at Edgetown and Middletown. Alphas range from a single score below .6 (Team Learning rating of Principal Tate in Middletown) to a high of .96, with 29 of 42 scores, or 69%, falling in the .79 to .96 range. Complete alphas and numbers for each principal are shown in Figure 5.7.

Sample Size and Survey Administration. *Edgetown.* At Edgetown, the survey was offered to all teachers, guidance counselors, specialists and administrators in the school in June of 2002, except for seven teachers who had not been in the school for a full year, were not assigned in the building, or were on leave for part or all of the 2001-2002 school year (and thus might not be able to judge leadership of the principal). The principal asked that 6 teachers whose contracts were not renewed be omitted from the survey, since their responses might be biased. Eight teachers/administrators said NO to the survey. Thus, out of 87 faculty members, there was a pool of 66 possible survey

respondents. Forty of those 66 actually completed their surveys for a return rate of 60%. Surveys were handed out at a faculty meeting in June, and were completed independently and returned individually in June, July, and August, 2002. The researcher's personal relationship with the faculty participants was an influence in the high rate of return.

Figure 5.7

Reliability Coefficients:  
All Principals at Edgetown and Middletown

	Edgetown			Middletown		
	1	2	3	1	2	3
	Marple	Fabrizzi	Stein	Tate	Marple	Goode
1. Systems Thinking (6 items)	.65 n=13	.72 n=17	.79 n=20	.69 n=11	.79 n=8	.83 n=11
2. Mental Models (4 items)	.72 n=23	.83 n=28	.87 n=37	.84 n=18	.81 n=12	.92 n=22
3. Vision (4 items)	.66 n=22	.86 n=26	.84 n=37	.64 n=16	.96 n=11	.93 n=18
4. Team Learning (3 items)	.72 n=22	.80 n=27	.65 n=35	.58 n=16	.89 n=10	.95 n=17
5. Personal Mastery (4 items)	.87 n=17	.75 n=19	.75 n=30	.87 n=12	.79 n=10	.86 n=13
6. Collaboration (5 items)	.83 n=21	.84 n=26	.83 n=33	.80 n=15	.92 n=9	.96 n=18
7. People Skills (5 items)	.84 n=20	.84 n=22	.79 n=33	.71 n=15	.68 n=12	.86 n=15

The numbers of respondents for each of the three principals and the percentage of the possible survey respondents from Edgetown are shown in Figure 5.8, below.



Figure 5.8

## Edgetown's Survey Respondents by Principal

Principal	Number	% of Possible Respondents (n=66)
Principal 1: Marple	23	35%
Principal 2: Fabrizio	30	45%
Principal 3: Stein	40	60%

*Middletown.* At Middletown, surveys were distributed to teachers' mailboxes on the teachers' first day back to school in September, 2002. The same criteria were used for establishing the pool of respondents. There were no non-renewals in the pool since the survey was done in the fall of 2002 in Middletown, so any non-renewed teachers were no longer on the rolls. Out of 110 teachers and administrators in September of 2002, there were fifteen new hires, and seven teachers/administrators who said NO to the survey. The researcher was able to interview Principal Goode on her last day on the job at Middletown. The new principal was not as invested in the project as Principal Goode might have been. While he allowed access to mailboxes, the researcher had little opportunity for personal contact with the faculty, who were engaged in the start of the new school year. Out of a possible pool of 88, 22 turned their surveys in by the end of October, for a return rate of 25%.

Nevertheless, the teacher interviews tended to confirm the impressions given of leadership traits on the survey, even though the n is small. Figure 5.9 shows the respondents by principal.

Figure 5.9

## Middletown's Survey Respondents by Principal

Principal	Number	% of Possible Respondents (n=88)
Principal 1: Tate	17	19%
Principal 2: Marple	17	19%
Principal 3: Goode	22	25%

Other Methods of Data Collection and Preliminary Analysis

Interviews. Principals. The principals were asked the same survey questions on the teacher surveys in a face-to-face interview which was tape-recorded and transcribed. The principals were interviewed in their offices at their current posts, except for Principal Marple, who was interviewed at his home. All five were interviewed between June and August, 2002. The table in Figure 5.10 shows the date of each interview.

Figure 5.10

## Interview Dates for Each Principal

1. Goffstown: Principal Marple	July 15, 2002
2. Goffstown: Principal Fabrizzi	July 22, 2002
3. Goffstown: Principal Stein	June 24, 2002
4. Middletown: Principal Tate	August 7, 2002
5. Middletown: Principal Goode	August 5, 2002

*Faculty.* Follow-up interviews with faculty in Edgetown and Middletown—six at each school—were conducted in December, 2002. At Edgetown, four teachers volunteered to be interviewed, indicating their willingness on the survey. Two other

teachers were asked, based upon their years at the school and their availability. At Middletown, four teachers who completed the survey volunteered to be interviewed. The researcher asked two other department heads for interviews.

A series of prompts for the faculty interview was developed with the assistance of Professor Barnett and Professor Krysiak (2002). The prompts shown in Figure 5.11, below, were used to elicit further comment when the interview subject seemed blocked. Interviews were audiotaped and transcribed verbatim.

Figure 5.11

Follow-up Interview Questions and Probes  
Regarding Leadership and Change

- 1. What has helped change at \_\_\_\_\_ High School?**
  - principal turnover?
  - opportunities for professional development?
  - collegiality?
  - experimentation?
  - high expectations?
  - availability of resources?
  - budget or financial issues?
  - teacher contract issues?
  - facilities?
  - community values influences?
  - school board?
- 2. What has hindered change at \_\_\_\_\_ High School?**
  - principal turnover?
  - opportunities for professional development?
  - collegiality?
  - experimentation?
  - high expectations?
  - availability of resources?
  - budget or financial issues?
  - teacher contract issues?
  - facilities?
  - community values influences?
  - school board?

Figure 5.11 (continued)

- 3. Which principal(s) do you feel best fostered or supported change?**
- 4. What qualities in their leadership helped to create successful change?**
- accessibility?
  - visibility?
  - support for risk-taking?
  - tangible support?
  - recognition of you/others as a contributor?
  - vision?
  - honesty/integrity/walking the talk?
  - courage?
  - compassion?
  - consistency/perseverance?

Exploratory Factor Analysis. An exploratory factor analysis was run on the survey data, using the combined data from Principal 3 at each school because the n would be higher. An examination of the rotated component matrix identified five components, but no overriding categories or classifications were evident.

Of course, the sample was not random, and the number of respondents was relatively small. Senge's model may not hold, or the items in this survey may not clearly identify distinguishable factors. Alternatively, the factor analysis may point to perceptual overlaps in the concepts. Runkel (1990) has suggested that finer and finer "slicing" of concepts into controlled variables does little to help us predict actions or understand concepts (p. 66), because life does not happen in a systematic S-O-R (stimulus-organism-response) way. Most real-life situations are far too complex to be adequately represented by a few controlled variables. And slicing the sample up into finer and finer sections does not aid our understanding. The New Science interpretations of reality support this view.

One way to look at results is to compare the faculties' overall ratings of leadership in their principals with the scores in the survey categories, to see if there are any patterns

that stand out. First let us compare the overall average ratings by factors, which can be seen in Figure 5.12 on the next page.

In the graph shown in Figure 5.13, the means of each principal's rating has been converted to a 4.0 grade-point average. The analogy was suggested by the way the overall evaluation question was set up on the survey. Respondents selected a rating for each principal as a leader:

- A. Among the very best. = 4.0;
- B. Better than average. = 3.0;
- C. Average. = 2.0;
- D. Below average. = 1.0;
- F. Inadequate. = 0.0.

Some respondents actually appended pluses and minuses to the "grade" they gave principal on his overall evaluation as a leader, and these scores could thus be recorded in the leadership gpa. MarpleE on the graph represents Principal Marple's Edgetown faculty rating; MarpleM represents his Middletown scores.

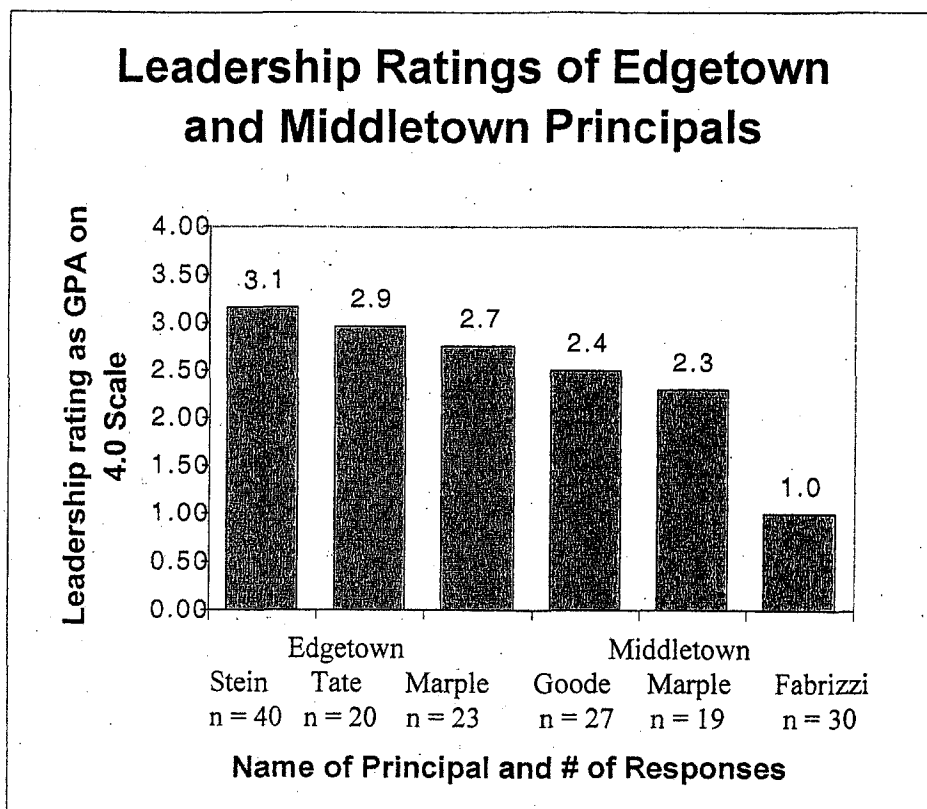
A more accurate picture of each principal's pattern of rating can be observed by examining the individual histograms as opposed to relying on the means of rankings, as displayed in Figure 5.13 above. The individual rankings are displayed at the end of Chapter 6 on pages 190-193. Edgetown Principals 1-3 (Marple, Fabrizzi and Stein) are shown in Figures 6.3, 6.4, and 6.5; Middletown Principals 1-3 (Tate, Marple, and Goode) are shown in Figures 6.6, 6.7, and 6.8.

Figure 5.12

Edgetown Middletown  
Principals' Leadership Ratings by Factors—Faculty and Self-Assessments

	SYSTEMS THINKING	PERSONAL MASTERY	MENTAL MODELS	VISION	TEAM LEARNING	COLLABORATION	PEOPLE SKILLS
<b>EDGETOWN</b>							
Marple-FACULTY	6.63	7.41	7.84	7.32	7.05	7.26	7.64
Marple-SELF	7.67	7.75	9.50	8.50	8.33	9.20	9.00
Fabrizzi-FACULTY	4.78	4.91	5.28	4.85	4.94	4.85	5.04
Fabrizzi-SELF	8.00	7.75	8.50	8.25	8.33	8.20	8.60
Stein-FACULTY	6.97	8.59	7.99	8.03	7.85	8.04	7.61
Stein-SELF	7.80	9.25	8.25	8.50	8.33	7.80	8.60
<b>MIDDLETOWN</b>							
Tate-FACULTY	8.15	8.33	7.67	8.56	7.94	8.00	7.44
Tate-SELF	8.00	7.75	9.00	8.25	8.00	8.20	9.00
Marple-FACULTY	5.96	6.10	7.15	6.09	5.63	6.84	6.95
Marple-SELF	7.67	7.75	9.50	8.50	8.33	9.20	9.00
Goode-FACULTY	5.06	7.05	7.48	7.05	6.85	7.10	7.65
Goode-SELF	4.20	7.25	9.25	7.25	6.33	8.00	7.40

Figure 5.13



If one compares the graphs of the three Middletown principals, one can see that the only one that approximates a bell curve is Principal Marple's ratings, although no one rated him as inadequate and two respondents rated him Among the very best, so his overall rating is better than average, showing up as a gpa of 2.30 in Middletown. Yet only seven respondents rated him Among the very best or Better than average, while seventeen rated Goode in one of those two categories and eighteen rated Tate in those two categories. In interpreting this data, we need to keep in mind that Marple was only at Middletown for one year, and in the designated role of interim principal. Many of the Middletown respondents did not evaluate his leadership traits, even though they were there for his tenure.

It is also interesting to look at Marple's Edgetown overall ratings (shown in Figure 6.3) compared to Marple's Middletown overall ratings (shown in Figure 6.7). After only one year at Middletown, the pattern of ratings indicated in the two graphs is similar, indicating a consistency of rankings in the two different school settings, although many more Edgetown teachers rated him above average compared to Middletown: 71% vs. 37%. The people skills mentioned by teachers at Edgetown are positively appreciated as indicated by the surveys and comments of the Middletown teachers, who gave Marple his highest average scores in the categories of Mental Models (7.15), People Skills (6.95), and Collaboration (6.84), as shown in Figure 5.12. Nevertheless, it's clear from the interviews that while teachers at Middletown appreciated Joe Marple's low-key, people-centered approach, they and he knew that his purpose as a one-year interim principal was NOT to initiate change. A one-year tenure is also a short time period in which to initiate change. Thus, in further examinations and conclusions about the principal as leader and change agent, Marple's scores in Middletown will not be discussed.

Of the five principals evaluated, the graphs show that Stein is clearly a standout. All of the other principals (with the exception of Marple in Middletown) were evaluated after tenures of four or more years; Stein was finishing his second year at Edgetown when his faculty evaluated him. Tate, Marple, and Goode are all rated by their faculties as better than average for their leadership.

Rating leadership of principals by factors provides a puzzling re-ordering of principal rankings: if the means of all the factors are taken, Principal Tate comes out number one with an overall mean of 8.01 and 4 ratings over 8—in Vision (8.56), Personal Mastery (8.33), Systems Thinking (8.15), and Collaboration (8.00). He also had a Team



Learning mean that was nearly 8 (7.94). Stein's high scores, similarly, were in Personal Mastery (8.59), Collaboration (8.04), and Vision (8.03), with high 7's in Mental Models (7.99), Team Learning (7.85), and People Skills (7.61). The ranking of principals by means of the leadership factors is shown in Figure 5.14 below.

Figure 5.14

Ranking of Principals by Mean of Leadership Factors:

Scale of 1-10, 10 being high

<b>Principals</b>	<b>Mean of Factors</b>
Tate (Middletown)	8.01
Stein (Edgetown)	7.87
Marple (Edgetown)	7.30
Goode (Middletown)	6.89
Marple (Middletown)	6.39
Fabrizzi (Edgetown)	4.95

The results are paradoxical, indicating that the qualities that cause teachers to rate their principals high in leadership toward change may not be accurately measured by the factors identified here; or principals may rank high on certain qualities but still not be successful in leading change in their schools, as is the case of Principal Tate in Middletown. The process of taking the mean (or even of assigning a score of 1-10 on a rating scale of a particular item) may also be inadequate as a way to try to quantify leadership skills. With this particular group of principals—Stein, Tate, Marple and Goode—trying to determine the “best” principal/leader by examining the means would be a difficult task. Context would be all, and the overlapping and integration of their skills and the occasions in which those skills were exercised would be the key to overall evaluation.

But a “worst” principal leader is clear. Principal Fabrizzi’s leadership rating is a D (1.00) on the gpa scale (see Figure 5.13 above), and 9 out of 31 (29%) gave him Inadequate ratings (See Figure 6.\*\*\*). It’s clear from his Overall Evaluation (Figure 6.\*\*\*) that most of his faculty (22 out of 31, or 71%) perceived him as below average as a leader.

Comparing Fabrizzi’s strengths and weaknesses with the scores of the other four principals, we might be able to discern some patterns that may contribute to overall ratings in leadership, but again we must be cautious because we are looking at only six principalships (five people), and of those people, none seem to be ranked as average in leadership. We have four effand our study of nonlinear, quantum reality reminds us that context is everything.

### Limitations

#### Researcher Bias

Because the researcher is a teacher at one of the schools, she has an insider’s view of the changes and the leadership styles of the principals at Edgetown. In some ways, being an insider in the school was an advantage: teachers who knew the researcher personally were more likely to be willing to take the time to fill out the survey. Also, the researcher had better access to the teachers, and thus the survey return for Edgetown was much better than it was for Middletown. But it is possible that partisanship of one sort or another comes into play in ways of which the researcher is unaware.

#### Restrospective Recollection

A possible weakness of the approach in this study is that the teachers must *recall* the leadership qualities of principals who may have been gone from the school for as

much as nine years. They may recall such principals fondly, or less fondly; but those recollections will be colored by the passing of time.

In addition, teachers' perceptions are sometimes limited to their own personal interactions with the principal. They may also be influenced—consciously and unconsciously—by perceptions of their colleagues with whom they discuss situations of importance.

#### Small n, Especially in Middletown

It was not possible to get personal access to speak to the whole faculty and explain the research process in Middletown, as was done in Edgetown. Communication with the respondents in Middletown was by way of memo via the teachers' mailboxes. Despite repeated reminders, fewer faculty responded, so these smaller numbers must be kept in mind when drawing conclusions about the views of the faculty as a whole at Middletown.

Nevertheless, the teacher interviews—representing a cross-section of departments and viewpoints—do tend to support each other and the survey results in terms of the principals' leadership qualities.

#### Limitations of the Survey Model

Senge's Five Disciplines of Leadership (1990) was the basis for the survey. The Interstate School Leaders Licensure Consortium Standards for School Leaders (Council of Chief State School Officers, 1996) was used to translate the five disciplines—personal mastery, mental models, shared vision, team learning, and systems thinking—into school terms. Items on decision-making style were included under the rubric of Mental Models. Because of the heavy emphasis on collaborative skills in the ISLLC standards, the category of Collaboration (in addition to Team Learning) was added. People Skills was

the category label to cover supervisory communication skills that did not seem to be covered in Senge's five categories.

Overall, principals who scored high on these individual factors also were ranked favorably by their faculties. But discrepancies in the analysis of the survey data lead to the conclusion that in some cases factors were not unique. For example, items which distinguished Team Learning from Collaboration may not have been sufficiently distinct. Qualities identified under Personal Mastery might also have been part of People Skills. A more extensive pilot evaluation—perhaps using several different school populations—might help to refine the instrument so that one could be sure that it measured items that it was supposed to measure.

Another possibility suggested by looking at the task through a New Science lens is that dividing leadership skills into separate factors is not entirely appropriate in a holistic world. The totality of the system and the interactions between leadership and change may be the most significant things. Senge (1990) has emphasized the *interdependence* of the learning disciplines, with the Fifth Discipline—Systems Thinking—as the most important:

...mastering the language of systems thinking also requires the other complementary learning disciplines. Each contributes important principles and tools that make individuals, teams, and organizations more able to make the shift from seeing the world primarily from a linear perspective to seeing and acting systemically (p. 135).

It is understanding one's job from the other side of the paradigm shift—"seeing and acting systemically," as Senge (1990) puts it—that often enables leaders to create effective changes and improvements. But in practical terms, isolating a few traits may

not give an adequate picture of the sophisticated combinations of decisions and actions that make up exemplary leadership.

#### Conflicting Interpretations of Leadership Behaviors

Where leadership and supervision are concerned, teacher perceptions of a situation often vary from the principal's perceptions. Here the factor analysis may be helpful, in that we can see that when a principal ranks low on People Skills, his overall ranking is correspondingly low. However, of the five principals in this study, four were rated better than average; none was rated average; only one (Fabrizzi) was rated below average in leadership. In addition, of the five principals studied, four of the five gave themselves approximately the same overall evaluation as their faculties did; only Fabrizzi rated himself significantly higher than did his staff. Without evaluating larger numbers of principals representing a greater range of leadership abilities, it's impossible to say which qualities are going to be most influential in high overall ratings.

#### Overcoming Limitations: Taking the Abstract, Conceptual View

Even as we discuss the limitations of this study, we are embroiled in a paradox: we are discussing the limitations of the study from the viewpoint of the old scientific model in which the goal was to minimize researcher effect and control all possible variables. One cannot look at one paradigm through the lens of another. From a New Science viewpoint, in a nonlinear system, we understand that a process which devotes endless hours to attempts to control things which are essentially uncontrollable is wasted time. We might embrace innovative research designs with less trepidation. We would understand that the qualitative observations we can make on the systems under study are going to be of more long-range benefit to understanding the workings of that system.

These understandings may assist leaders to shape change, or at least to understand the systemic factors which may frustrate their efforts.

In talking to the principals themselves and discussing their leadership and influence on change with teachers who were at the school during their years as leader, at least a bit of the complexity in situations of much change (Edgetown) and little change (Middletown) can be examined. Looking at this data provides a retrospective understanding of how leadership style and specific situations intersect. (See the conclusions in Chapter VII for more on this.) That understanding can add to the model for the 21<sup>st</sup> century of how leadership can influence change in a complex system like a school.

Chapter VI will present the composite leadership profiles of the five principals in our study, along with the faculty's ratings of the principals and of change at their respective schools. Chapter VII considers the interaction of leadership style and change at Edgetown and Middletown, draws conclusions, and suggests areas for further research.

## CHAPTER VI

### LEADERSHIP AT EDGETOWN AND MIDDLETOWN: PRINCIPAL PROFILES

RESEARCH QUESTION: What meaningful insight can be gained from retrospectively observing the interaction between change and principals' leadership styles at two New Hampshire high schools?

I have served 7 principals at 4 schools. Communication with the school population, "the vision thing" and effective management skills are the most important to me. A great principal is the spiritual leader of the school or finds someone who can fill that role.

--Middletown teacher survey response,  
October, 2002.

#### Attitudes towards Change in Edgetown and Middletown

Edgetown High School has clearly made changes in the ten years from 1992-2002; Middletown has not changed very much. This next section looks at how the principals and faculty view change at their schools. Extensive quotation will be used in order to let the voices of the speakers (principals or teachers) be heard. Following that will be the leadership profiles and the discussion of the interaction of leadership and change.

#### Attitudes towards Change at Edgetown

##### Principals' Views of Change at Edgetown

In ten years, both principals and teachers would see Edgetown as a school in a state of fairly constant change. Principals Marple and Stein selected "fairly constant change" during their tenures; Principal Fabrizzi selected "has had many changes."

### Faculty View of Change at Edgetown

The histogram in Figure 6.1 on the following page represents the faculty's view of change at Edgetown, with 25 out of 39 respondents selecting "fairly constant change" and another nine selecting "has had many changes." (Middletown's Faculty View of Change is also shown, for easy comparison.) Thus 90% give Edgetown a high change rating. Only five (13%) selected "has had an occasional change" and no one picked "has rarely changed."

While the six teachers who were interviewed in Edgetown generally saw change as positive (change is "okay"; "we have changed, and for the better"), they also clearly recognized the burdens and stresses that come as a result of change at a rapid rate. One teacher in a follow-up interview commented on the way turnover in leadership seems to accelerate change so there is a sense of constant change: "those of us who have been at the school for ten years are on overload...with the number of things that are coming down." Another teacher expressed a similar yearning for more stability:

Change has happened so quickly and it keeps happening all the time, which is okay. But I think if we're going to make some changes, something has to stay the same for a little bit of time, so we don't feel as if we're always bouncing around.

A third teacher said,

We add things to a program but we never remove things. If you don't, I think it's hard to effect change because you still have everything else on your plate, and sometimes you have to be able to clear things off your plate to be able to put new thing on, or the plate becomes so full that people start turning away from the changes that you're trying to implement.



Figure 6.1

Faculty View of Change at Edgetown High School, 1992-2002

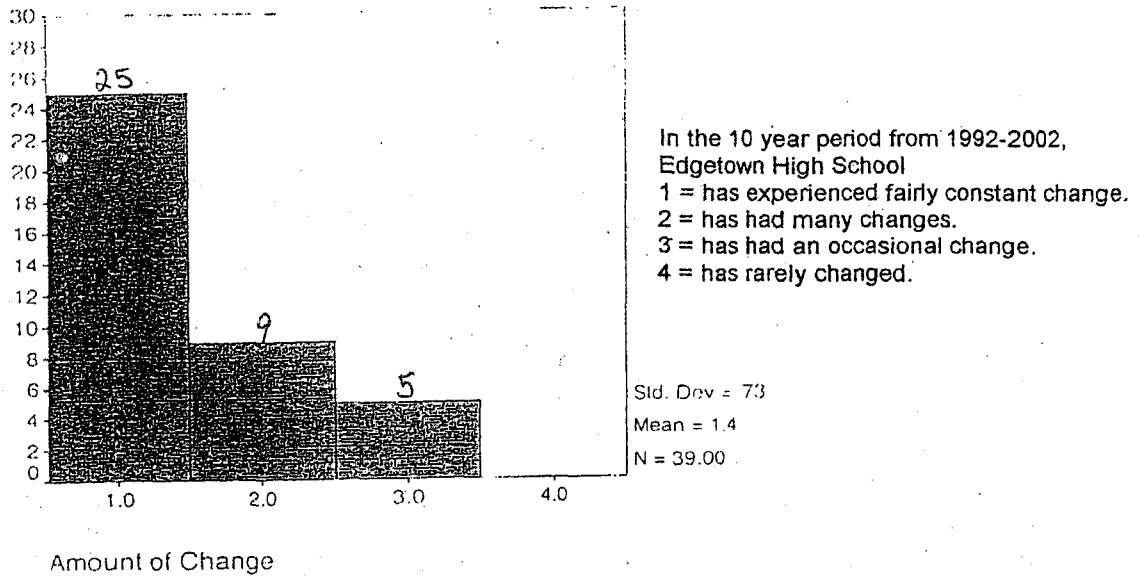
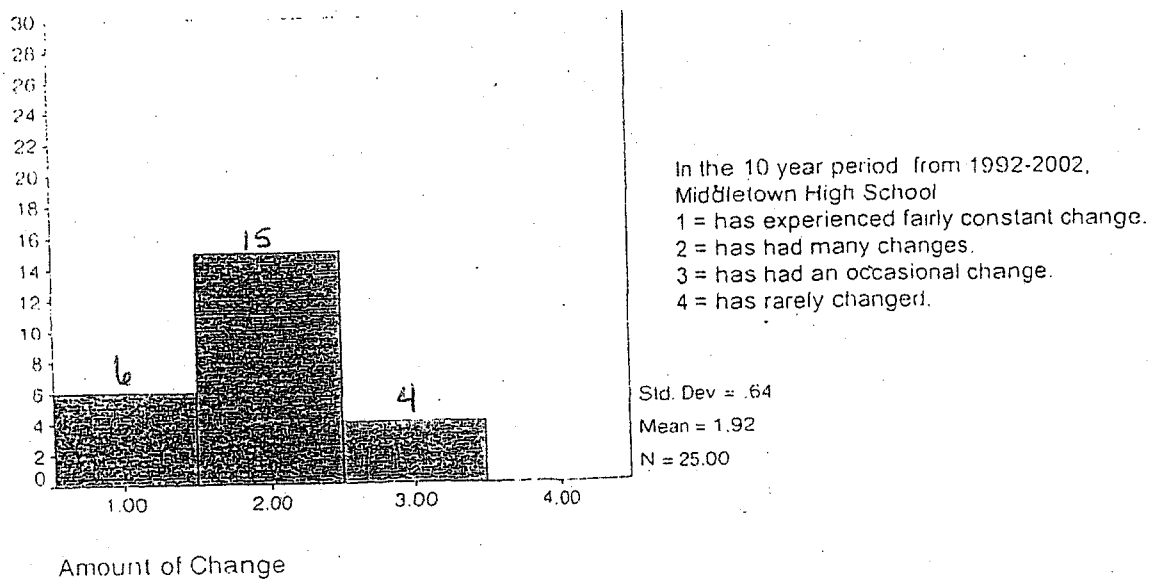


Figure 6.2

Faculty View of Change at Middletown High School, 1992-2002



Having changes “on your plate” was a metaphor used by a fourth teacher in this way: Sometimes the change comes in such big loads and they put so much on your plate that it’s a lose-lose situation because things are hanging off the side of the plate, and you’re losing it anyway. Things would change and be more efficient if we had mini-servings instead of an eight-course meal. . . . We have changed, and for the better—but we’d be further along if things weren’t piled so high so you are set up to have things topple over, and then it’s your fault.

It’s not new news to report that change is stressful. That stress is demonstrated clearly in the comments above.

Attitudes towards Change at Middletown

#### Principals’ Views of Change at Middletown

Tate’s analysis of change at Middletown during his years as principal for the period of the study—1992 to 1997—was “Middletown has had an occasional change.” Marple—who followed Tate as one-year interim principal—called for a faculty vote on the issue of instituting block scheduling at the school, which had been studied by the faculty for several years, starting under Tate’s leadership. According to Marple, the faculty defeated block scheduling by a margin of three to one. His conclusion was that Middletown was a “teacher-dominated, teacher driven school” with the advantage that it was a very predictable environment, but the disadvantage that students did not get to play a role or take part in decisions involving their educations. “They [the faculty] were too content and happy with the status quo,” Marple said. He selected “has had an occasional change” as his descriptor of Middletown High in his one-year tenure as interim principal.

Goode (1998-2002), on the other hand, ranked change as being “fairly constant” during her four years as principal. In that time period, the high school renovation was completed, the school added and integrated computer technology, and the school did

change to a modified block schedule—not by a vote of faculty but by administrative fiat. Several significant changes did occur in the four years of her tenure.

Bud Tate provided insight into how change was inhibited at Middletown during his administration. There was pressure within the school not to change because of satisfaction with the status quo; there was a different kind of pressure from outside of the school, from an ultra-conservative school board. Tate describes the frustration of trying to move ahead (with a pilot mini-reform for the ninth grade and a revised health curriculum), and the way his role as leader shifted under those circumstances:

Initially, I felt as though we had begun to look at some different ways of thinking. My perception of Middletown High School is that it's a very traditional school. Extremely traditional. Extremely bureaucratic in terms of the district. In some ways that's okay; in some ways that is not very good. So...we were gradually looking at trying to do some things that were different. Not so different, I think, educationally—but certainly different for that community.

And so I saw my role as one to ask questions—to run some interference for people who were kind of following up on the questions, or had their own questions—and take some of the heat if there was heat to be taken, support that change. . . . My role was more supporter, making sure we were tackling the right things, prioritizing.

Then, I would tell you, my role changed *drastically*. At that point I became more of a *protector* of where we were, because philosophically, our board changed *dramatically*. We had an ultra-conservative board. So my role at that point was more maintenance, and protection.... And I had to be very concerned with the people, and the kids. At that point we were just hanging on and trying not to go—in my opinion—backwards. And so that's what I tried to do. I don't know how effectively I did that, but that's what I tried to do. . . I would tell you that we never made major change, but we

were moving like that [studying block scheduling], and then all of a sudden, there was a drastic change [the school board elections], but it was not from our initiation. In my opinion we went like this: we went into a cocoon for two or three years. And we were *protecting*.

Tate's remarks make clear the impact that the environment outside of the school can have on leadership within. In this case, possible change in the school was effectively stymied by a board unwilling to consider innovation: the change that had been under consideration—named the Jefferson Plan—would have instituted a heterogeneously-grouped school within a school for under 100 students in the ninth grade (very similar in design to what actually *was* instituted for the whole ninth grade in Edgetown at about the same time). Because of the opposition of the school board to this change and others, the principal's role as a possible change agent developed to one of "protecting" the teachers, curriculum, and students from the possible regressive acts of a conservative school board.

#### Faculty View of Change at Middletown

The faculty at Middletown, asked to rank change in the 10-year period from 1992 to 2002, ranked change more positively than might have been expected, as shown in Figure 6.2. The principals for the first six years had selected "has had an occasional change"; the principal for the last four years selected "fairly constant change" to describe her four years at Middletown. Fifteen out of 25 faculty respondents (60%) said Middletown "has had many changes"; six out of 25 (24%) said change at Middletown was "fairly constant." Thus 84% rated change high at Middletown, though not in the same proportions as Edgetown (see Figure 6.1). Four said there was an occasional change; none said the school rarely changed. It may be that the bias of taking only one measurement is showing: the most change at Middletown has taken place in the last four

years, under the leadership of Val Goode, and this is the freshest memory of the respondents.

One teacher in the follow-up interview, when asked what has hindered change at Middletown High School echoed the comments of Bud Tate, saying,

I don't know: I guess comfort level. "If something's not broken, don't fix it" kind of mentality. If people sense that things are going well—and for the most part... this system is very well run—that tends to not necessitate a lot of change.

So for almost ten years, a very well run system and school hardly changed at all.

Several of the teachers interviewed in Middletown supported Tate's view of the situation under the school board "that very much opposed any things that would have been progressive in education research at the time." Another teacher commented that during the time when the school board was "micro-managing everything,...things pretty much were as stagnant as you can be in a school setting."

The effect of board attitudes and policies carried over to possible resources that might have benefited the school as one department head pointed out in a follow-up interview:

Middletown completely missed out on the School-to-Work funding—which is really a tremendous loss to a school and community this size—because it was federal money and the school board at the time that that money was available was absolutely unwilling to consider any federal grants because of the possible strings attached and loss of local control. I think that was a huge impediment [to change].

Similarly, the town voted against an article that would have accepted monies from a State Adequacy grant for the new addition to the high school, rather than bonding the project. The grant would have saved the district the total cost of the interest over the years of the bond period; but the town said no.

## Profiles of Leadership

Each of the principals received an overall ranking of their performance by their faculty: the results are shown in the histograms in Figures 6.3–6.8, which are grouped together at the end of the chapter, for easier reference and comparison.

The leadership profiles which follow include interpretations of those rankings and descriptions of leadership style culled from the principal and teacher interviews and from occasional written responses on the teacher surveys. The follow-up interviews provided broad and detailed agreement on leadership characteristics of the principals.

### Edgetown's Principals—1992-2002

#### Principal Marple at Edgetown (Tenure: 1981-1996)

The first principal of Edgetown during the ten-year period of study, Joe Marple, was coming to the end of a long career in education—over forty years, serving as teaching principal or principal at six different schools in New Hampshire, and then as interim principal (after retirement from Edgetown) for four one-year stints at four different schools, including one year at Middletown High School.

Although he had many years of varied experience, Marple reports that his attitude towards leadership underwent a change just prior to 1992, partly as a result of his CAGS studies at Northeastern University (he cites Sergiovanni's humanistic models of administrative leadership as influential), and partly as a result of the SIP (School Improvement Program) training which emphasized collaborative decision-making. Marple describes the change this way:

I figured for many of my years as principal, I was really an outsider, even though I was building principal, because I was brought up and trained initially in the top-down model. My earlier master's degree in [State College] was all top-down: you're the principal; you make the decisions. If you happen to want to involve people in making decisions, be careful in how much you do. So. . . many times even though I was building principal I was the one outside: I wasn't part of the internal workings of the staff because I was looked at as the one who makes the decisions—right or wrong—and being in that authoritarian position or relationship, I was an outsider.

My experience with SIP [School Improvement Program] has proved one thing to me: unless change comes from within, it ain't gonna happen. Or if it happens, it won't last. Now I've found that rather than diluting my status as a principal or my effectiveness, it enhanced it to share the decision making process. I became more influential rather than less influential. People were coming to me frequently to get my input: What do you think—is this going to work? Is that going to work? What's the agenda for the next SIP meeting? Should it be this? Should it be that? Whereas if I were making all the decisions—right or wrong—and NOT involving other people, they could care less.

In addition to the shift in attitude, from authoritarian, top-down decision-making to the collaborative model advocated by SIP, Marple describes his leadership as “a people business”:

People have to see you as someone who cares about them: getting from where we are to where we want to be is a process that involves people. People have lives, people have concerns, fears, happiness, sadness, challenges--.

I think that people look at a building level leader—they can look at that person in several ways. It's fortunate if they look at that person as someone who knows what he's doing or she's doing, is bright, reasonably well organized, has good follow-through, can move the school, can utilize and recognize the talent that exists in the staff—that's all PLUS. But if that person is perceived as cold, aloof, uncaring, only concerned with the end result, that might work *opposite*. In the humanistic model, you care about them; some like you better than others, but people realize that you do generally care about what happens to them. You trust their decisions, you trust their problem-solving, you trust their integrity.

Marple described the way his leadership changed after he began to share decision-making, and emphasized the importance of people skills in leadership.

The six teachers interviewed supported Marple's self-reporting, talking about his leadership. One teacher said, "he's a humanitarian type person that thinks about people a lot. . . . He fostered change by trying to communicate with each person individually." Another described him as "so kind." A third said of him, "as a person, he was very easy to talk to, and he had a lot of good ideas; he was just a really nice man. He had compassion." A fourth said, "Joe was a fine person, and certainly knew the research about secondary education, was personally a great guy who cared a lot about this place." A fifth said, "Joe always listened." In general, the survey respondents and faculty interviewed saw Marple the way he presented himself.

Nevertheless, in the last four years of his administration at Edgetown, Marple may not have had the energy or follow-through that might have characterized his earlier years there. This idea was supported by several comments: one teacher said

I was not here until 1993. . . I guess I got here after Marple's best years—he was in his lame duck period. He was near retirement. He was tired. He'd worked hard. He was a trustee at State College, which took him out of the building a lot. He just wasn't here a lot. Good guy—he genuinely cared about kids—but he was not here.

Another said, "Marple was at the end of his career and he was tired." A third said, "Administratively, he might not have been as strong, because sometimes there was no follow-through." One teacher, who was a student at Edgetown when Marple was principal, commented, "Mr. Marple—I never even saw him. . . . I never ever saw a principal or an assistant principal in a classroom when I was here as a student."

Figure 6.3 shows Edgetown teachers' ratings of Marple's leadership. Overall, fourteen teachers out of 24 responding rated Marple as Better than average, with 3 teachers rating him Among the very best. Six rated him average, and one person rated



him below average. No one rated him as inadequate. These ratings agree with Marple's self-assessment score of B.

Principal Fabrizio at Edgetown (Tenure: 1996-2000)

Frank Fabrizio came to Edgetown with seven years of administrative experience, four as an assistant principal and three as a principal. Of his work at Edgetown, he ranks curriculum change and alignment as number one, and the NEASC re-accreditation work number two as his accomplishments. In terms of the principal's role in relation to changes at Edgetown, Fabrizio expressed a sense of powerlessness:

I know a lot of research now says that it [the role of the principal] is THE most important aspect of making change. I agree with that, although not totally, because you can't separate the principalship from the connections it has to students, community, central office. You need to be an active and important part and a leader in the change, but sometimes you don't necessarily have all that much control over what happens. I suppose it's like saying that the president has certain executive powers, but yet there are certain things that even the president can't control. You have to be able to have the diplomatic skills and the political skills in order to be able to work with all those disparate groups all the time to try to push your agenda forward.

Fabrizzi was hired by interim superintendent Hubert Smith, and then a different superintendent—Doran Hansen—came in midway through Fabrizio's term. It was clear by the way that Fabrizio responded to the question on the change process that conflicts between him and the superintendent had occurred, and Fabrizio did not prevail:

I certainly didn't resist the change. Although there were times, when I think, as the district level administration changed, I had some concerns

about where some of that was going. I thought we plunged into the last year [the change to block scheduling in 2000]. I would have probably handled that change differently, even if I was calling the shots on that one. It was important to change the schedule, but I think there wasn't enough planning for that and I think the change in software and the change in schedule two months before the school year started—I don't know how it played out for you, but I would have done it differently. I think that was way too much, way too soon. And I'm one who likes to be on the forefront of what's important to education....

[So would you say that those changes were initiated at the district level?]

Yeah. I mean, I think there was discussion around it, but I think there were some important things that needed to be done relative to the schedule, but I think to blast ahead and put that together in such a short amount of time and then change the software, and change who was going to do the work to implement that schedule—boy, I had some real reservations about how all that went. So I wouldn't say that necessarily was resistance, but to me that was constructive feedback, knowing your school, knowing the culture. That might be overwhelming.

The change in schedule did have faculty support because all faculty had been involved in visiting schools with exemplary practices to look at schedules. A Best Schools grant from the state had supported this effort. But it's clear from Fabrizio's comments here that he was resisting change, and that in this case the decision to move ahead with the change was made "over his head."

The teachers' comments showed awareness of the central office conflict, and some sympathy for Fabrizio who must have felt a certain amount of frustration as the principal who was hired by one superintendent and then had someone with an entirely different agenda appear in the central office with different, unanticipated demands. One teacher said,

I think Fabrizio has been given kind of a bum rap in some ways. . . . There's always a window of learning and growth curve. In your first couple of years as a leader, oftentimes you want to make sure that you're pleasing all the powers that be, and as a result, sometimes you can turn people away. I think maybe if he was given more time in a leadership role, some of that might have turned around.

Another teacher observed, “I don’t think Frank was able to fight for what he believed, with the school board. I think he was pushed around a lot. [He] kind of ran on other people’s coatstrings, so I think he was a transitional guy.” A third teacher observed flatly, “Fabrizzi was hired to clean house, and when they [the central office administration] were done using him, they tossed him.”

A fourth teacher analyzed the situation similarly, with some sympathy, but also distinguishing what she saw as Fabrizzi’s limitations as a leader:

I don’t see him as a leader; I see him as a manager. I think he was brought in to manage the system. I almost feel sorry for the guy, because I think what happened was, following Marple—because he [Marple] was just so kind, and people thought he was so loose—they [administrators in central office] wanted to bring in someone who was going to kind of hold us tight. Then I think you bring Hansen [Edgetown Superintendent since September 1998] into the midst of this, and Hansen has a vision for public education, and Fabrizzi can’t keep up with that, because Fabrizzi’s just a highlighter with a school board policy trying to manage a system. I think that was his charge. And then you go from Hubert Smith [former Edgetown interim Superintendent, who hired Fabrizzi] to Hansen, that charge changes; and I don’t think Fabrizzi intellectually was able to keep up with it. So probably I wouldn’t classify him either as a leader or as a person with a vision, based on what I just said.

Fabrizzi’s own comments in response to the question “How do you get your staff to share your vision for the school?” indicate some confusion about what vision is and the role it plays. He says,

Edgetown was a difficult place: there was a lot of disparate philosophy. But we had a lot of hiring opportunities, too. I think I was just starting to see the fruits of some of that. In some ways, I think I walked into a vision, because you had already done that work as part of the accreditation process. But then, I think you have to make the vision live. I think we started to do that when we got into Best Schools and we posted the vision. . . . Actually, I remember on the first day of school, you did that whole activity with your kids on the vision. I still remember to this day. That kind of thing was important in making the vision real. . . . Now if you can get 60 people to do that, it’s great. But I think those are ways in which it can be done. You meet with people, you talk the vision, you post the vision. I think the down

side to it all is that high schools are big and complicated places. There's a lot of demands from a lot of different areas, and your energies become diffuse. My understanding—and certainly Essential Schools'—is that the principal has to be the keeper of the vision.

Fabrizzi's position that the principal has to be "the keeper of the vision" is not supported in any of what he says about vision, which he presents instead as something already established that needs to be "talked about" and "posted."

It appeared from teacher comments that Fabrizio's strengths were organization—"he was very thorough, and he didn't want to make steps in any rash or disorganized way"--, and to some degree personal skills. The same teacher who described him as organized also described him as having "compassion." Another teacher described Fabrizio as accessible, while acknowledging,

I don't know if other people did—I never had an issue with Frank [Fabrizzi]. . . I found Fabrizio very kind. To me that's very important, also. It's fine if you have the brains, to be really bright. I'd rather somebody who was bright, but not exceptionally bright, and *kind*; than MENSA bright and *mean*..

The implication seems to be rather a backhanded compliment, suggesting that Fabrizio was "bright, but not exceptionally bright."

Another teacher saw Fabrizio as "an autocrat", while acknowledging that he may have been hired to play that role. For her, a limitation was how he communicated with people through letters and memos: "If I remember correctly, it was... the years of the memos. And there were many of them. . . . That might have been one of his downfalls, that he chose to communicate via writing rather than communicating face-to-face."

Another fault noted by four of the six teachers interviewed was ineffective communication with students: "I didn't see a lot of rapport with kids," one said; "Fabrizzi was afraid to be out in the hall," another commented.

Overall, during Fabrizzi's tenure there was a lack of support for risk-taking and a negative atmosphere attributed to the principal's leadership, so much so that one teacher said, "I was ready to quit under Frank Fabrizzi. I can remember coming home one day, literally in tears, and telling my husband I don't want to go back, and his begging me to hang in there at least until we got our kids out of college."

Fabrizzi's overall ratings are shown in Figure 6.4. In the overall ratings, nine out of 39 (23%) respondents assigned him the lowest ranking, inadequate. His average score was 4.0, with thirteen (33%) teachers giving him that grade—below average. Thus, over half (56%) rated him poorly—either below average or inadequate. Eight (21%) teachers ranked him as average; only one (3%) teacher ranked him as above average. No one rated him as Among the very best.

#### Principal Stein at Edgetown (Tenure: 2000-2004)

Principal Adam Stein came to Edgetown with twenty years of varied experience in educational administration: five years as assistant principal in a large high school, fourteen years as principal at a class I (Intermediate) school, and one year as assistant superintendent in a newly-formed interstate school district.

Stein describes himself as interested in "transformational organizational development" and cites Michael Fullan, Taoist thinking, and Outward Bound as influences in his leadership: "The one thing that I carry around is a quote from the Tao T'Ching: 'A good leader, when he's finished, people say "Oh, we did this ourselves!"' and that is my real strong interest." Stein describes the school as in a state of "constant change" since the beginning of his tenure there, using the words "steward" and "shepherd" to describe his role in relation to change at the school. He sees his way of

accomplishing changes as coming from listening to the people in the school:

I listen to what people have to say and I see that they have certain things that are exciting for them; I choose those things, so I get what I want by choosing what other people have already decided on. It's exciting and they're invested in it.

Stein understands change as a process, using the metaphor of guiding an airplane or a boat. His description of the leadership process can be found in Chapter VII.

Stein's self-description of his attitude toward fostering change is supported by teachers' statements about him. One teacher describes the process of empowerment in detail:

. . . where Adam shines is his ability to see the strengths in other people and to let them foster those strengths. I see him as a person who can seek out and say, "Mary Singer is really good at X, so we'll let her go ahead with X." and "[her own name] is really good at this, we'll let her go with this." . . . it all comes back together as working really well, as opposed to saying "Well, Mary, you're going to do this, even though we know that's something you can't stand doing, or it's a weakness of yours, or whatever. I think that's a real skill that he has, to be able to see that in people. . . He's good at letting people make decisions on their own.

This comment provides a clear validation of how Stein describes his own attitude, to lead by supporting what other people are already invested in.

One new, young teacher who started her teaching under Fabrizio said, "Mr. Stein has been our biggest change by fostering a calmer and more open community; looking for new, innovative ideas. . . and being open-minded about them; . . .and fostering respect among kids and teachers." She saw Stein as "very consistent, persevering and . . . compassionate."

Another teacher saw Stein as an effective communicator with both kids and faculty who models a casual professionalism in his dress and demeanor, commenting that the effect of leaving the power suits in the closet is to create an atmosphere with less emphasis on power: “I think in some ways being more approachable is better.” She commented on how Stein’s style creates comfort: “Adam has been wonderful to work with. I feel supported, I feel valued.”

The written comments of teachers taking the survey reflected how highly teachers valued this quality of feeling supported. Stein brought several new teachers to Edgetown with him, teachers who had worked under his leadership before. One wrote on her survey,

I worked at another school under Adam Stein for a year. It was a wonderful experience. School morale was high & school culture was like none I’d ever experienced. After Adam left, the school started to have problems under the new principal. Made me realize how KEY good leadership is to a school. Adam is a leader. I came to Edgetown HS because of Adam. He makes me want to be a good teacher, to have high standards, & to succeed. I don’t really know what Edgetown was like before him, but I do know what Union [Stein’s previous high school principalship] was like after he left.

Three teachers described Stein as a “risk-taker,” one of them even referring to him as a “cowboy” who “likes to go off and do his own thing, and hopefully people are with him.” One teacher wrote just one sentence at the end of his survey, “I feel that Adam Stein is an inspiring, awesome and influential leader.”

Although the faculty overall gave Stein the most favorable ratings of the three Edgetown principals, the comments reflect some conflicting opinions and some lack of sureness, which may be partly due to his having been on the job for only two years at the time of the survey. One teacher acknowledged his vision while expressing reservations about the support evidenced by Stein:

...he's a visionary, Adam, and he has a ton of great ideas. But I think a lot of people are confused by some of them. He wants people to think, and that's a good thing. He also gives a lot of empowerment to us. Doesn't want to give you the answers; wants you to think of the answers. But they better be the right answers.

Stein's Overall Evaluation by Edgetown teachers is shown in Figure 6.5 on page 201\*\*\*:

Thirty-three out of 41 (80%) rated him as either Among the very best (39%) or Above average(41%). Six (15%) rated him as Average and two (5%) rated him Below average.

No one rated him as inadequate.

Middletown's Principals—1992-2002

Principal Tate at Middletown (Tenure: 1988-1997)

Principal Tate had described Middletown as “a very traditional school. Extremely traditional. Extremely bureaucratic in terms of the district.” As mentioned earlier, significant change did not really occur during his years as principal (1988-1997), but he did try to initiate change, expressing some degree of regret at not being successful, for example: “That wasn't well-received by faculty.” Or, when Tate tried to get faculty to look at test results in a different way, he says, “I don't know if that was a significant change, but it was trying to get people to look at things differently. I was having a hard time getting our faculty to look at it that way.”

Tate's method of leadership was to do what he could to move the culture toward more openness and more consideration of new ideas, first articulating what he was hoping to have happen, and then “having *a lot* of little conversations with *a lot* of different people. And then every act you do, however small, has to be consistent with that. That's what I try to do.” Thus he expressed his belief in building consensus by moving many people in the direction of his goals using small, incremental steps.



Tate's teachers supported his self-description. One said,

Bud Tate was very progressive in his ideas, was *extremely* methodical, so any change that might have happened under his tenure would happen at a very slow and measured rate. Momentum may be lost, and things may not actually come to fruition, because sometimes you can analyze something for so long that you lose the zest, you lose the enthusiasm for it.

The comment expresses the downside of change by small, incremental steps: while the train is just sitting at the station, waiting for everyone to get on board, there is not that much interesting to look at or get involved in. The passengers may all fall asleep.

Another teacher commented on the fact that Tate asked for staff opinions, but people "started getting the feeling that he didn't really want it." This teacher believed in administrative direction, saying about block scheduling,

It's the kind of thing where, as an administrator, if you really believe in something and you're in charge, you ought to just tell everybody, "Well, this is what we're doing." He [Tate] tried to get people on his side and it just didn't work so he left shortly thereafter. . . . I kept thinking he must have read it in a book somewhere: "foster consensus." To me, personally, I like working with administrators who know they're supposed to be administrators. I don't want to do your job. If you want to give me part of your salary, I'll do part of your job. But if you have a decision to make, you make the decision. Either it works, and you made it; or it doesn't work, you made it. Don't drag me into it. I can go along with whatever.

Another teacher commented on Tate

Tate thought things through a little more, . . . a little bit more careful, . . . but he had kind of a vision, I think, and he just matter-of-factly stepped us through it as best he could. I remember him with *The Seven Habits of Highly Effective People* [Covey, 1989]. He made me read it; he made a number of us read it. That type of leader. . . He was involved in lots of things. . . He was a big player in the NEASC whole process; he was on the board for NEASC. So he was on top of whatever the latest thing was that NEASC wanted, so he tried to reflect that. Bud would lead all kinds of committees. He would kind of have his hand in everything, kind of moving things in his direction. But I always kind of felt that he had a sense of where he wanted us to go.

Another former teacher, now an administrator in the district, described Tate this way:

I think his strength was to empower people, to say, “Look, I want us all to come up with this together. I want your ideas. I value your ideas. What do you think?” He would sometimes say, “You know, I don’t quite agree with that, but I want you to try it. It’s a learning experience, and see if it works. Maybe it will work.” He was very supportive in that way. That was really a strength for him. . . . He would actually come up to where you were and say, “How’s that thing going that you were trying out?” I just remember him always being there to support.

Tate’s overall evaluation is shown in Figure 6.6 on page 191: Eighteen out of 21 (86%) gave him favorable ratings: threere (14%) rated him Among the very best; fifteen (71%) rated him Above average. Two (9%) rated him as average and one rated him below average.

#### Principal Marple at Middletown (Tenure: 1997-1998)

Marple retired from Edgetown, and then took on the one-year post as interim principal at Middletown after Tate left to take another position.

Within that one-year time frame, most of the teachers interviewed felt that Marple’s role as interim principal was simply to maintain the system, rather than to try to change things. He himself expressed his role in that way, “not to be engaged in new initiatives, but to support initiatives that had been undertaken.”

Various teachers commented on his limited role:

--“Marple was okay, but he knew what he was there for.”

--“Marple was only there for a year and his job was just to get us through for a year. Change wasn’t a big part of that.”

--“His attitude seemed to be that he was just keeping things steady for the next person, so I don’t think he wanted to effect a lot of change.”

--“The only administrator within the last 10 years that I can think of who was not extremely strong on increasing our technology was poor Mr. Marple—who can’t really be judged in that respect because he was an interim. . . He didn’t have the power to do any of that. . . Mr. Marple just

kind of tried to keep us functioning. . . trying to make sure that we don't get ourselves into a position so that the new person isn't in such a negative setting that they don't have a chance to be successful."

The administrator interviewed for this project saw one other side of Joe Marple's short administration that was beneficial for Middletown:

He was able to break the ice with budgetary things because he was an outsider who could come in and say, "Look, I don't have anything to gain by this; I'm just telling you I've been in other school districts, and these people need to have more in their budgets. Honestly." I think maybe he got us more change in that direction. . . . He brought us the vision of other schools, other districts. . . . And that was a good thing to get us to look outside of Middletown, and look at other spots.

Most teachers interviewed denigrated Marple's role ("poor Mr. Marple"); some people responding to the survey filled in ratings for Tate and Goode, but included no evaluation for Marple. Perhaps they felt that in only one year it was not possible to make judgments on leadership: several wrote DK for Don't Know all the way down the Marple column. But one teacher agreed with the perspective of the administrator quoted above, writing this comment on the back of his or her survey:

I would like to offer some insight as to why Joe Marple received strong, positive ratings from me. Joe Marple was an interim principal. As such, Joe felt free from "political" pressures and did not feel that he had to act in a way that would ensure his longevity in the Middletown School District. Every time I went into his office with an idea or with a request that involved spending a reasonable amount of money, his answer was invariably "Why not?" At faculty meetings he rarely gave us mandates, but instead made suggestions based on the wisdom acquired over a long, successful career. His leadership was subtle, accomplished by guiding rather than forcing. His decisions were made with the student's best interests in mind—something that is not as common as it should be. A true breath of fresh air.

Thus two respondents viewed Marple at Middletown after one year with similar positive regard as his admirers at Edgetown: he was seen as a kind man who cared about kids.

Although the teachers at Middletown did not rate Marple as highly as the Edgetown teachers had in Overall evaluation, they agreed with the teachers at Edgetown with regard to Marple's personal way of relating. One teacher contrasted Marple's style with the style of the other two Middletown principals, whom he described as "pretty aggressive, pretty hard-driving, pushing *themselves*." He said, "You compare that to Mr. Marple! [He laughs.] He's a lot more laid-back style. And that's okay, too, and that works out well, too."

Marple's Middletown ratings are shown in Figure 6.7, on page 192. Nine out of 19 (47%) rated him as Average; seven gave him favorable ratings, with two teachers (10%) rating him Among the very best and five (26%) rating him Above average. Three teachers (16%) rated him Below average. No one rated him Inadequate.

#### Principal Goode at Middletown (Tenure: 1998-2002)

Val Goode, Principal 3 at Middletown, sees the role of the principal in relation to change at a school as significant, especially as a "guide on the side":

The principal can be a change agent in terms of encouraging people to try new things, encouraging people to go to other schools and see what's going on, encouraging people to watch each other, encouraging people to stay current about what's new in education, what's going on, and what might work in education; so I see the principal in the BEST way as being a facilitator; and so that would be facilitating the initial thoughts, and then facilitating the change. It takes a while...—remembering you've got people in the whole scheme: you've got people who are resisting kicking and screaming even until the change is practically old hat. Understanding that that's the way some people work, ...and you don't do change just for change's sake—but in education if you're not moving forward, you're really losing ground.

Goode may have shared the ethic for hard work with her predecessor Bud Tate, but it was clear from talking to the six respondents at Middletown that her style was quite different from his.

One respondent categorized Val Goode as

a little bit of a risk-taker—more so than the others. Val was, in comparison [to Bud Tate] probably a little more scattered around, in different things. More likely to be influenced by other people, by what they had to say, than Bud was. Much more of committee decisions.

A department head said,

Val Goode was a big maverick for change. She was a problem solver. I see her as a tremendous instrument of change. Her style was to be very supportive of new ideas, and not haphazardly, but more “we’ll deal with the problems that result as they come up” so things got done a little more quickly. . . . I think she did some of those things really quickly, and within procedure, but didn’t wait for something to die on the vine. I think she was very maverick and courageous in her approach.

Another teacher saw Goode as “more open to change and less restrictive. . . .

Under [Tate] there was always concern about if we do some things, the liability.

Liability was always a big thing, and I felt it was less so under Val. . . . I think I would say that she was more of a force for change.”

That same teacher described the qualities in Val Goode’s leadership that helped to create successful change this way:

She was very open. She had excellent people skills. People trusted her. Her door was always open. She was very approachable. . . . She was very encouraging and supportive of any ideas that people would have. She would listen to you and allow you to experiment with something, and you did not have a big fear of failure. If you tried something and it flopped, oh well. [It was okay?] Yeah.

Another teacher contrasted the leadership styles of the two principals Tate and Goode, finding Tate more structured, with everything pre-approved and traditional, while

Val was as opposite as you could possibly get from Bud. Now spontaneity was the key to success, and all the structured teachers were extremely frustrated by the spontaneity of decision-making going on.

Although this teacher is sympathetic to her highly structured peers who were happier with Tate's leadership style, her own teaching flourished under Goode:

I had the opportunity [under Goode] to do lots of different things. I don't think I ever got turned down for anything. I don't think Bud ever turned me down, either, but I didn't feel as much freedom to just go and say, "Hey Bud, I heard about this! What do you think?" because I knew that it would require of me a lot of preliminary paperwork before he would even consider it. . . . With Val, she was not going to throw away an opportunity that came up just for the sake of paperwork. So personally I found Val's style to be much more beneficial for me to do different things within my classroom setting. . . . In terms of change, I definitely found Val's leadership to be much more conducive to experimentation and change.

On the same theme, one teacher wrote on the comment section of his or her survey "[I] loved her vision & stability...she made you feel part of the process."

But just as some teachers at Edgetown expressed discomfort with Stein's "maverick" style, one teacher at Middletown expressed very negative feelings towards Goode. The teacher attached three written pages to her survey, explaining that the first-choice principal candidate of the faculty search committee (of which she was a member) had been overruled by the superintendent, and Ms. Goode was hired instead. This inauspicious beginning was followed by "the deterioration of Middletown High School at a quick pace," attributed by the writer to Goode's "so-called leadership." The writer was relieved at Goode's resignation in August, 2002, and the promotion of Tim Benton (former assistant principal): "Evil has left and the good is going to return." This powerful condemnation seemed to be personal rather than an objective evaluation. It may possibly have been a reaction to the less predictable, risk-taking leadership style of Goode, whom the respondent contrasted with Tate's "positive" leadership, which she claimed allowed the school "to always improve in the best way possible for students, faculty & administration."

Two teachers also mentioned specifically Goode's emphasis on technology. One tied it to Marple's having "broken the ice" in getting the money budgeted for needed technological improvements: "Val did the same thing [as Marple], having come from a different school system and having a different background, different kind of school. And I think technology was really a strength for her. She would have advanced us even more had she stayed. She got a lot of people beginning to use resources that had never used them before."

Another teacher commented, "She took the opportunity with the renovation of the building to move us from the old tech ed model to a more electronic age—I think that was a huge change for this building."

Although Goode's Overall ratings—shown in Figure 6.8 on page 203\*\*\*—were favorable, with seventeen out of 28 (61%) giving her favorable ratings, and seven (25%) rating her as average, she seemed to elicit strong negative feelings from a minority with three teachers (11%) rating her as Inadequate. One teacher rated her as below average. Comparing Perceived Leadership Qualities of Principals at Edgetown and Middletown

Of the five principals surveyed, four were judged above average in leadership by their faculty who responded to the survey. In the ten year period under study, change was initiated by Joe Marple at Edgetown and continued—despite Frank Fabrizzi's perceived ineffective leadership in the middle years—throughout the decade. At Middletown, Bud Tate's attempts to create similar change were blocked by an unsupportive, antagonistic school board, but his leadership style of small, incremental change was perhaps a contributing factor to the lack of change at Middletown. Joe Marple was not seen by

most of the Middletown teachers as an especially effective leader, yet two of them recognized continuing impact of his approach and skills as quoted above.

The “mavericks” Stein and Goode—the third principal at Edgetown and Middletown, respectively—share the qualities that Senge (1990) and Wheatley(1992) emphasize as important in an age of change. From most reports, they seem to both be risk-takers who empower others to take risks as well. In that atmosphere, growth and change can more easily take place. It is significant that the one restructuring change at Middletown took place under Val Goode’s impetus: block scheduling. Under Tate, the faculty studied it; under Marple, the faculty voted it down; under Goode, the modified block was instituted by principal’s fiat, because the principal believed that the students needed it.

#### Aspects of Leadership

It was clear from comments made by survey takers during the pilot that many of the items required interpretation in order to make judgments. Unless the survey was individually administered, the respondent is on his or her own to interpret the question as she or he sees fit, and the experimenter can not be sure that the respondents’ interpretations of the questions are the same as her own.

A further limitation is the time at which the survey was given: respondents were asked to reflect retrospectively on the qualities of the leadership they had experienced in the years they had been at the school: in some cases, they were thinking back eight to ten years; in some cases they were basing decisions on only one or two years of observations. A much more accurate portrait of leadership could be obtained by accumulating and comparing annual or bi-annual ratings.



In light of these limitations, despite fairly strong reliability coefficients—as reported in Chapter V—caution should be used in interpreting specific strengths and weaknesses of leaders on the basis of survey data alone. This survey has the support of the teacher interviews to confirm the analysis of the data and the self-analysis of each principal. Together these data provide for rich leadership profiles for each principal.

#### Interaction of Leadership and Change

Nineteen ninety-two, the starting year for this study, was not the first year of tenure for either Marple or Tate, the first two principals of Edgetown and Middletown during the ten-year period covered by this study. Both of them were experienced, knowledgeable, well-liked principals with a clear understanding of best practices. Each had a similar vision for his school: at Edgetown, it was the heterogeneously-grouped core team program (growing out of the school's involvement in the School Improvement Program) initiated in 1992; at Middletown, it was the similar Jefferson Plan Pilot Program, (developed—with Tate's approval—by a team of teachers at the school), defeated by town ballot in 1994.

#### The Will to Change: How Leadership Interacts with Environment

Both Marple and Tate, according to their interviews and the testimony of their teachers, wanted to create change in their schools. Marple succeeded in setting changes in motion; Tate's change efforts were frustrated.

Two key differences were the administrative structures in the high schools and in the school districts, and the situations in the communities. Edgetown's governance could be described as unstable, while Middletown's administrative structure was solidly secure. Although both districts suffered during economic recession, Edgetown was less

supportive of its schools and budgets than was Middletown. Middletown also had school board controversies in the mid-1990s that worked against school change.

#### Change and Leadership at Edgetown

In Edgetown, the positions of department heads had recently been abolished, and the school district had been through frequent changes of administration at the district level. The town of Edgetown showed its lack of confidence in the school system's leadership year after year through the inability of the school board to present budgets which the town would vote for (see Chapter V, Figure 5.2); the superintendency turned over every three years as the town and board sought appropriate district-level leadership (see Chapter V, Figure 5.4).

Against that background of community mistrust of the schools and internal instability in district and high school department leadership, Edgetown's Marple found a small window of opportunity for change; he convinced, cajoled, or forced a critical mass of teachers to implement something new. Midway through the first year of change (1992), the twelve teachers who were piloting the heterogeneously-grouped core team program were all convinced that the program was better for students. They were committed, and so were the parents whose children benefited from the increased teacher/parent communication that came about as a result of the teaming of students and teachers. The momentum of that positive change carried forward through the four-year administration of Principal Fabrizzi, who would have put on the brakes, if he could have. But once Superintendent Hansen took the reins at the district level (midway through Fabrizzi's tenure)—bringing order and confidence in the budget-building process and a vision for the district—the changes continued.

Edgetown had become a school where the teachers were beginning to define *themselves* as risktakers. Principal Adam Stein, hired by Superintendent Hansen, was the risktaking leader the school had been waiting for. This is demonstrated by the high leadership rankings given to Stein after two years on the job (See Figure 6.5).

#### Change and Leadership in Middletown

By contrast, in Middletown the departmental structure was a well-integrated, well-running aspect of the administration of the school district. Middletown's superintendent Justin O'Brien had been part of the district administration for 35 years through 2001. The respect for competence and efficiency that O'Brien had earned through the years contributed to the satisfaction of the townspeople and the school people with the quality of their school. There was no need to "fix" a school where nothing was "broken." Bud Tate's leadership style at the high school, requiring extensive pre-planning before action was taken, with small incremental steps taken towards change, fit well with the structured administration in Middletown, but was not conducive to initiating school change. Maintaining enthusiasm over time was a challenge: while Tate was waiting for everyone to be ready to move ahead, enthusiasm flagged.

Still, Tate's small, incremental changes might have had some cumulative effect on the faculty over time if it had not been for another anti-change force in the town: the right-wing fundamentalists who took control of the Middletown school board in the mid-1990s, forcing the principal into "protecting" mode.

Every trivial or insignificant act, like the flap of a butterfly's wing, can have long-lasting and unanticipated effects. According to teacher interviews at Middletown, part of Goode's later success in moving the faculty forward in the use of technology was due to

the influence of Joe Marple, who brought the perspective of an outsider to the school district in his one-year tenure as interim principal as he prepared the school budget for Middletown. He told the board, “This is what we need to make changes in the school that are needed to catch up in technology,” and his comments were perceived as unbiased and credible because of his breadth of experience and his perceived objectivity as an interim “outsider.” Despite the fact that many teachers dismissed “poor Mr. Marple” as insignificant as a leader, some teachers recognized him as playing a key role as a change agent.

Following Joe Marple’s stint at Middletown, a risk-taker took the helm: Principal Val Goode, hired from outside the district. After extensive study of block scheduling options under Tate, the teachers had voted against such a schedule modification during Marple’s interim tenure; now they achieved change through fiat. Not bound by Tate’s promises not to “force” change on teachers not ready for it, Goode implemented a modified block schedule in the fall of 2000. Goode’s leadership created polarized responses from faculty (See Figure 6.8), although the majority of respondents rated her as above average.

The changes at Middletown during the ten-year period from 1992-2002 looked relatively small compared to the more sweeping restructuring that happened at Edgetown. Still, Middletown had undergone a school renovation/building project, had updated and added computer technology, and had shifted (suddenly) to a modified block schedule—all within the three years from 1999-2002. This may help to explain the surprising finding that so many of the faculty overall (as represented by the sample surveyed) saw Middletown in 2002 as a school that changed frequently (see Figure 6.2).

Val Goode herself selected “has been in a state of fairly constant change” to describe Middletown High during her tenure there.

#### How Leadership Happens

Leadership happens when principals see and seize opportunity in the right conditions. Some personal qualities and skill sets may make leadership more effective, and a contemporary understanding of chaos theory and quantum reality as it relates to leadership may certainly make the process of leadership feel less *stressful* for the leader, as he or she can become more aware of the waves and breezes sweeping through the system. In the conclusions in Chapter VII, the learnings suggested from these two schools will be discussed in more detail, and recommendations for further investigations will be made.

Figure 6.3

Overall Leadership Evaluation: Principal Marple at Edgetown

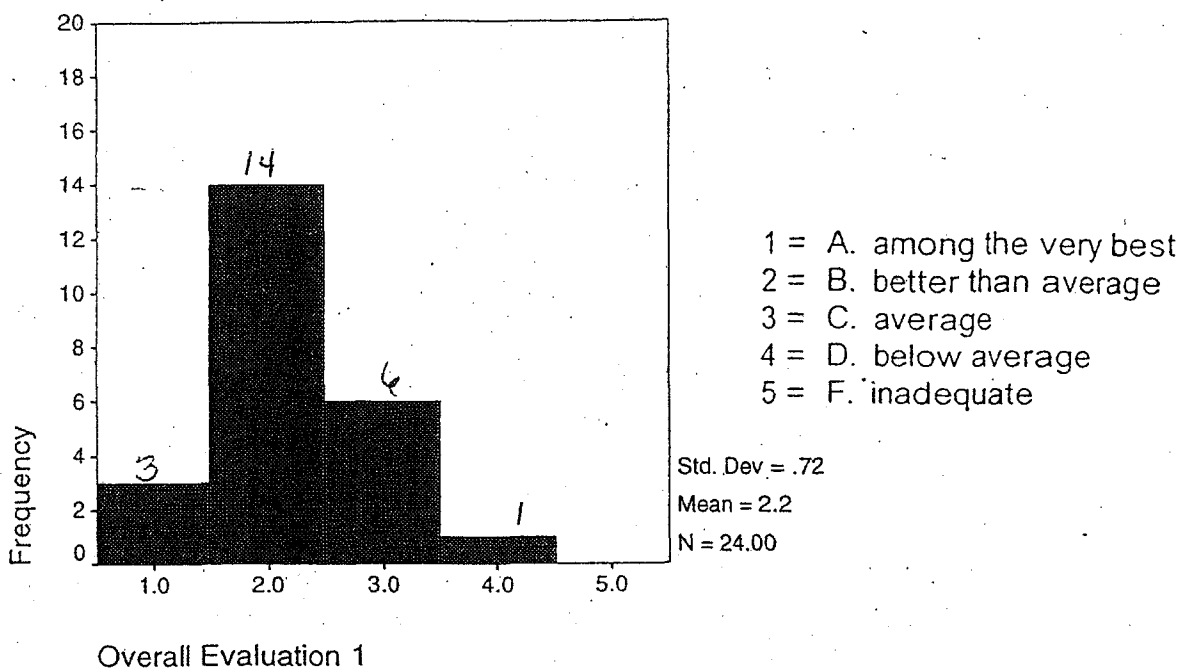


Figure 6.4

Overall leadership Evaluation: Principal Fabrizzi at Edgetown

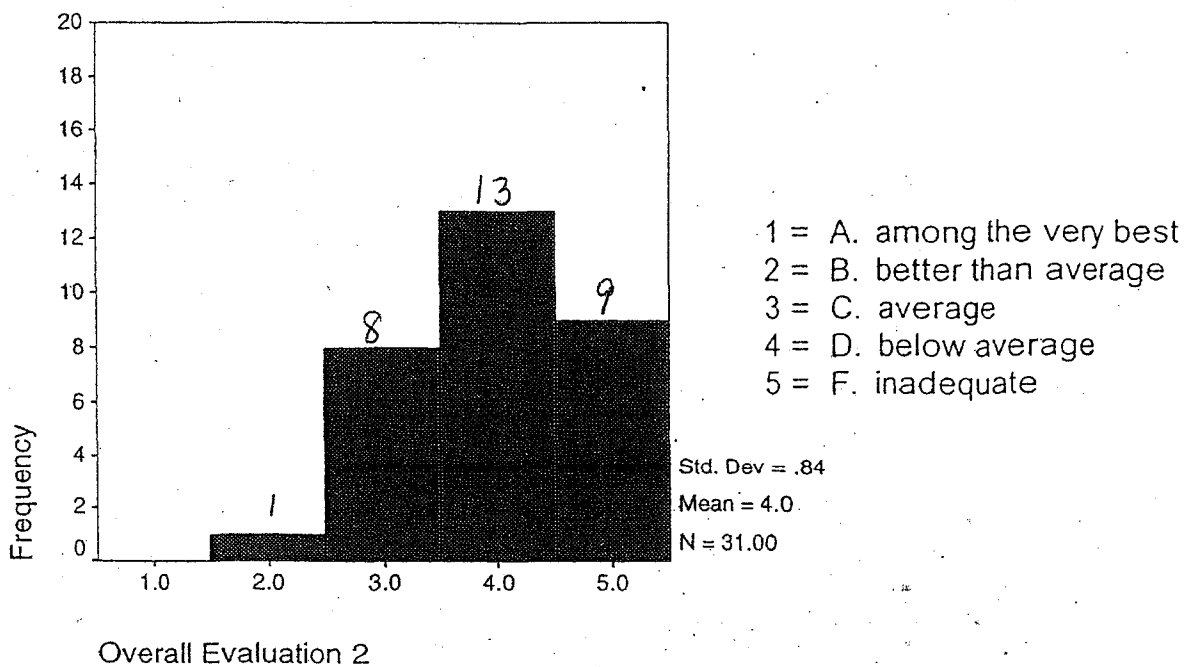


Figure 6.5

Overall Leadership Evaluation: Principal Stein at Edgetown

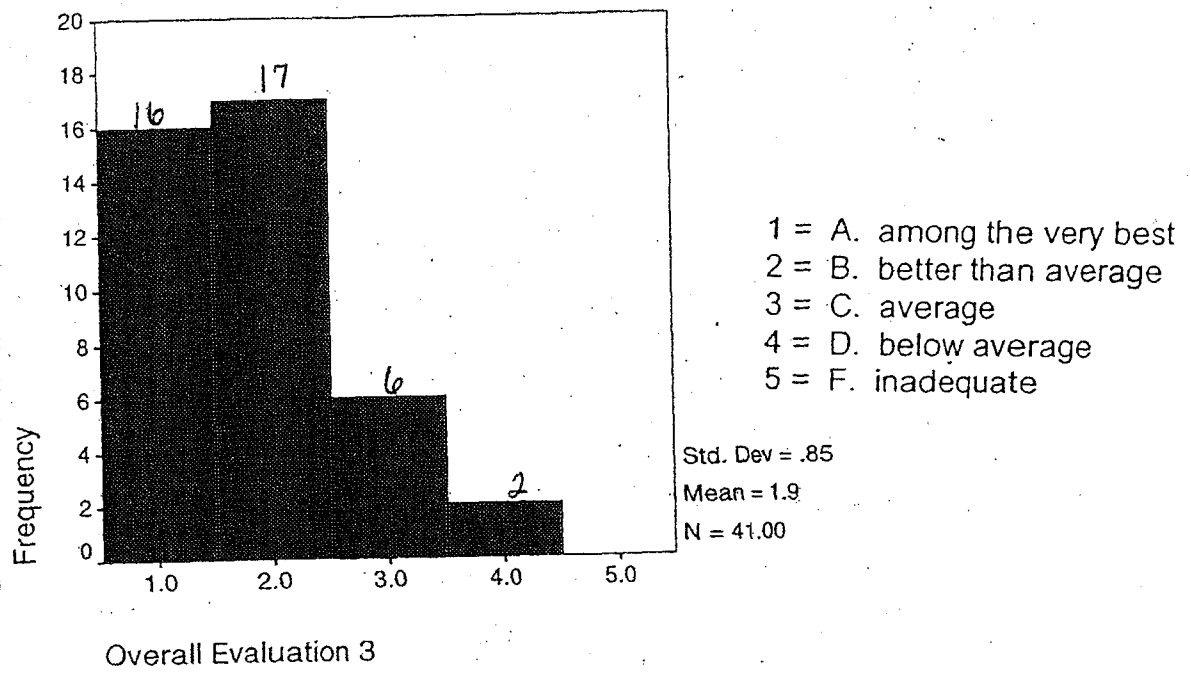


Figure 6.6

Overall Leadership Evaluation: Principal Tate at Middletown

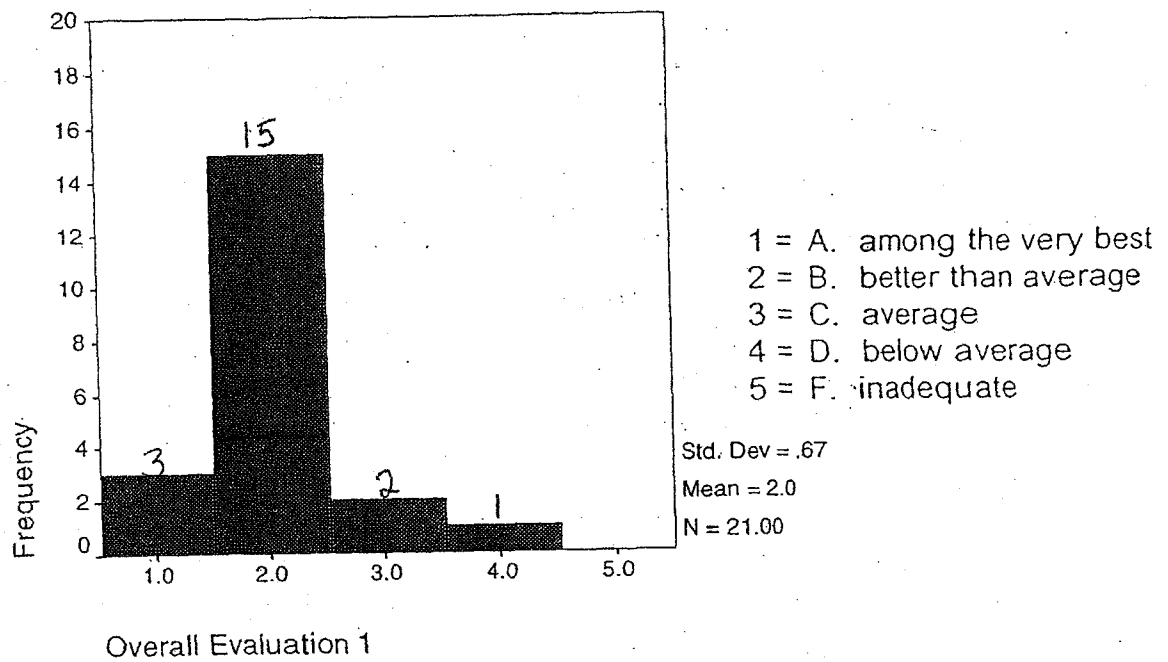


Figure 6.7

Overall Leadership Evaluation: Principal Marple at Middletown

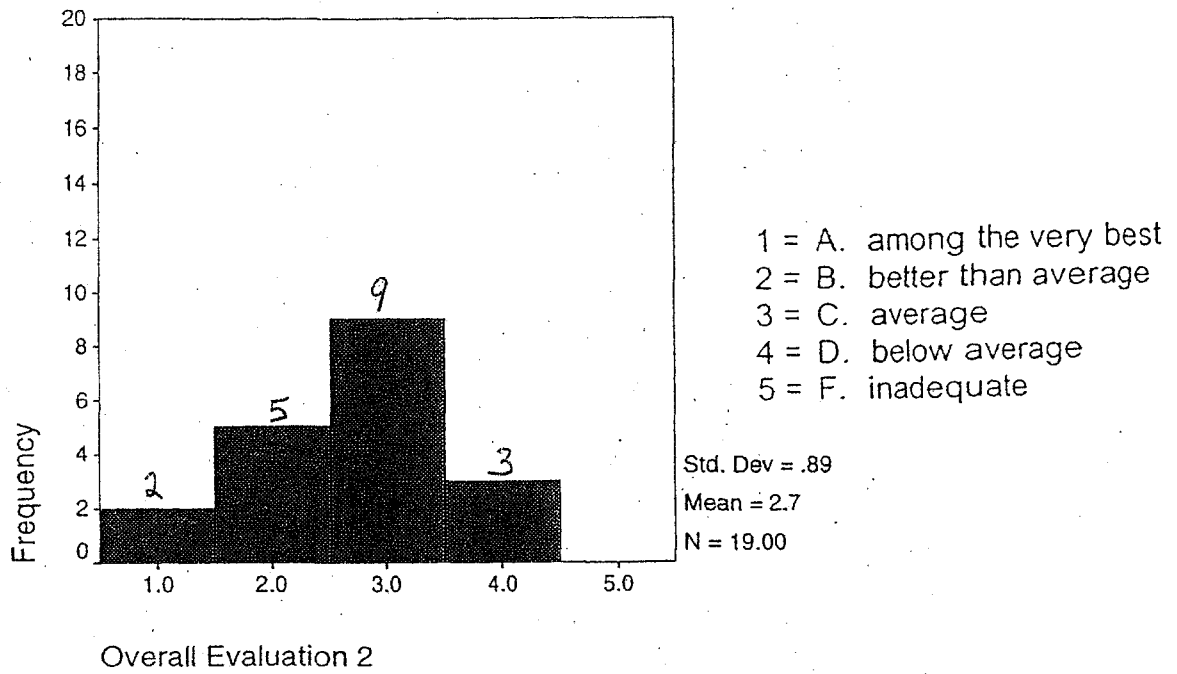
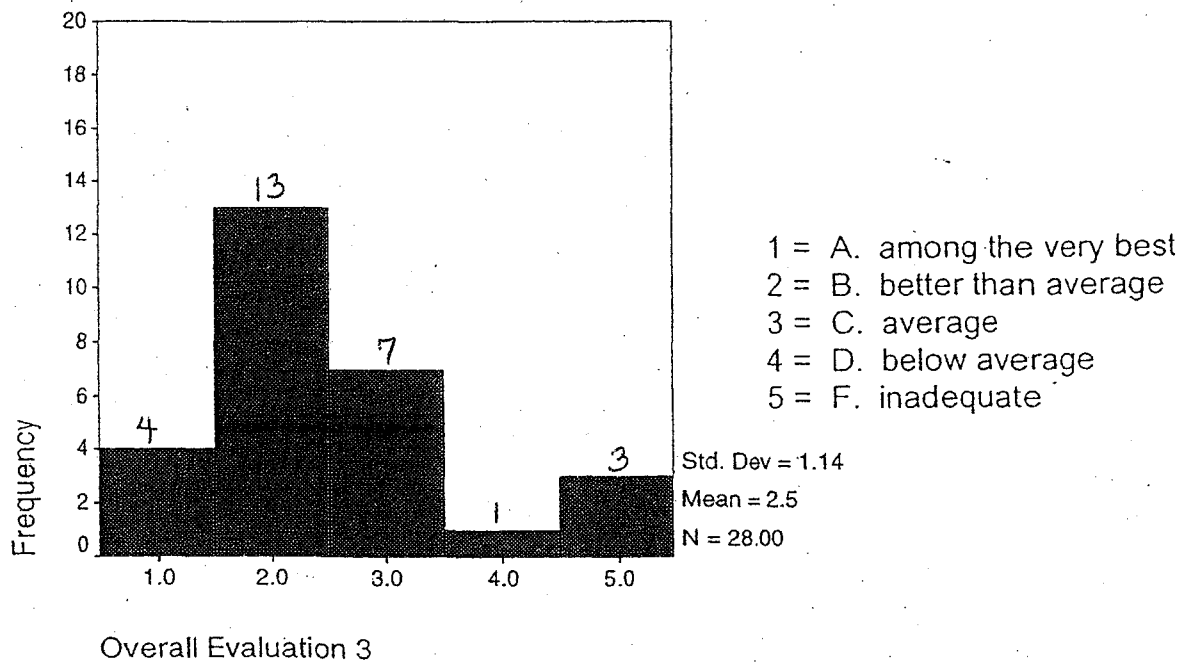


Figure 6.8

Overall Leadership Evaluation: Principal Goode at Middletown





## CHAPTER VII

### FROM CLOCKWORKS TO WHIRLPOOLS:

#### DISCUSSION, CONCLUSIONS, AND DIRECTION FOR THE FUTURE

*Order means reliability, predictability, and control. But it also means limitation.... At the point where the river meets the stones or the twigs and forms itself into whirlpools, it is poised delicately between order and chaos, between being in control and out of control... --adaptive and creative.*

*--Danah Zohar (1997, p. 76-77)*

#### Shifting the Paradigm

The title of this dissertation—*Shifting worlds: Leading educational change in quantum universe*—implies a paradigm shift. T.S. Kuhn's *The structure of scientific revolutions* (1962) provides a theoretical understanding of how paradigm shifts take place in science. The shared assumptions and practices to which scientists are committed are challenged by some new fact or theory. The new information requires a reconstruction of prior assumptions and the reevaluation of prior facts—a challenging and time-consuming process. The established community may offer resistance, clinging to the familiar and rejecting the new theories in the same way a believer rejects evidence which might challenge his or her faith. When a shift does take place—a scientific revolution-- “the scientist’s world is qualitatively transformed [and] quantitatively enriched by fundamental novelties of either fact or theory” (p. 7).

The scientific revolutions necessary for scientists to embrace quantum theory and chaos theory have already taken place. In other fields—business and education

leadership, for example—the shift is still in process. This dissertation is a “mopping-up” operation as Kuhn (1962, p. 23) defines it, looking at the connections between New Science thinking and educational leadership, examining the match between the paradigm and leadership, and further articulating the paradigm in educational terms.

This chapter presents a final discussion of the interactions of change and leadership of the principals at Edgetown and Middletown, as they fit into the New Science paradigm; it suggests directions for future research; and it draws conclusions as suggested by the theoretical and empirical components of this dissertation. At the end are metaphors on leadership suggested by the interview with Principal Stein at Edgetown. The goal is to present these metaphors of airplane’s pilot and ship’s captain—not especially new metaphors in terms of leadership—*from the other side* of the paradigm. No longer will we consider leadership from inside a clockworks; instead we will see how these metaphors take on an enriched meaning when viewed from inside a whirlpool.

### Educational Leadership and Change in the New Science Paradigm

#### Understanding the Situation

Burns’ (1978) historical view of leadership suggests that many people have leadership qualities, but that the *situation* must be right in order for those leadership qualities to emerge. When we talk about school leadership—especially high school leadership—we are talking in most cases about a rigid institution that resists change. If the school is not already engaged in a process of change, if the stakeholders are not committed to a process of growth that incorporates regular change and refinement; then the leader’s job must be to change the culture so that that engagement and commitment

can take place. In other words, the leader must be constantly aware of the situation so that she or he can find the leverage points to create the right *situation*.

#### Becoming Comfortable with Discomfort

Creating that shift of attitude may be “complex, difficult, and challenging intellectually and emotionally” (Reeves, 2002, p. 24), for these reasons: “In a high-performing district, many people think that change is unnecessary. In a low-performing district, many people think that change is not possible. In any organization, people know that change is uncomfortable” (p. 24). The New Sciences paradigm suggests that people must be *comfortable* with being *uncomfortable* in order for change to take place (Barnett, 2004).

In this study, Middletown represents the high-performing district with relatively little impetus to change; Edgetown represents a more “middle-of-the-pack” performance level, with the additional instability of leadership within the school (department head positions abolished in 1990) and at the district level (frequently changing superintendents). Change at Edgetown started in 1992 with the establishment of the ninth grade core program, and has continued since then. Both Joe Marple in 1992 and a critical mass of his teachers were convinced that change was needed, and that it was worth the discomfort of change to try to improve the situation.

By contrast, the years from 1992 to 1999 in Middletown represent a period of little change. As Reeves (2002) points out, teachers and principals have all witnessed failed change initiatives, leading to cynicism and lack of motivation to expend the energy necessary to change. That certainly happened in Middletown when the Jefferson Plan was turned down. Teachers and leaders can bear discomfort if convinced that there will

be long-term benefits to students. But to propose changes, invest time and energy in the proposals, and then see the proposal fail: that creates a lack of tolerance for the whole process—an unwillingness to be uncomfortable. That process works against establishing a climate in high schools where change can be embraced.

#### “Very Well-Run Schools” May Be Less Susceptible to Change

Schools are, as Peter Senge says, “remarkably difficult institutions to change” in Senge, et al., pp. 57-58). Paradoxically, Middletown—“a very well-run school,” according to its principals and teachers—was less susceptible to change. The bureaucratic structure and confidence in the excellence of the leadership created a sense of comfort that was almost impossible to disrupt. But even in low-performing school districts, such as New York City Public Schools, the forces against change can seem overwhelming, as New York Mayor Michael Bloomberg and his newly-appointed Chancellor of Education Joel Klein are finding out (France, 2003; CBS News, 2003). The New York goals are to improve the success of the students, increase efficiency, and eliminate duplication; and the plan rests on the success of the principals—they are the ones who lead the schools. A key component of the reforms is a special leadership academy to train new principals and retrain the ones that will be retained (CBS, 2003). Jack Welch, former General Electric CEO often quoted in Senge et al. (1999) *The dance of change*, is in charge of the training academy. New York Superintendent Farina credits Welch with a key idea that offers optimism for positive change:

You can't allow an organization to grow complacent. When you find those kinds of organizations, you have to tear them apart and create chaos. That chaos creates a sense of urgency, and that sense of urgency will ultimately bring [about] improvement (Farina as qtd. In France, 2003).

In order for Middletown to change, the school needed a little less complacency and a little more sense of urgency: a small dose of chaos. Chaos is uncomfortable, but revolution requires it.

#### Leaders Must Seize Opportunities for Revolution

Change can revolutionize the system, as Alinsky (1971) suggests in his *Rules for radicals*:

The organizer goes with the action. His approach must be free, open-ended, curious, sensitive to any opportunities, any handles to grab on to, even though they involve other issues than those he may have in mind at that particular time (p. 165).

The leader (or organizer of a tactic in making a revolution, as Alinsky would say) must also have “an easy acceptance of apparent disorganization” (p. 165). It’s a difficult task to accomplish, especially in a school—where apparent disorganization of *any* kind may be viewed as ineffectiveness or failure. The lack of organization in the last few years of Joe Marple’s tenure was part of the perceived reason that Frank Fabrizzi was hired to “clean house” at Edgetown.

#### Staying in Motion

Given the difficulties, a principal/leader convinced of the necessity of growth and change might almost despair, if it weren’t for the reinforcement that New Science thinking offers. New Sciences suggests that in order to change, one must embrace the discomfort—to unbalance the current position in order to be in motion to a new location (Barnett, 2004). The image of the leader as the prime mover in a giant clockworks is outmoded in a New Science world. Instead, the leader might imagine the approach to a whirlpool in a tumbling, moving stream which must be navigated, somehow, with head above water. The leader needs to line up the right conditions to create a pyramid through

which changes can cascade. *If* every effort is made to understand and perceive the parts of the system of which the principal/leader is a part, *if* the right leverage points in the system can be determined, *if* the people in the school system (students, parents, teachers, parents, community members) can be engaged in the process of building and sharing a joint vision for growth and success, *if* a few key people can learn to feel happily uncomfortable in risky situations—*then* the Butterfly Effect of chaos theory tells us that change can be rapid and complete. But achieving a single change—or even a series of changes—is not the goal in a quantum universe. The goal is to stay *in motion*, with one's head above water more often than not, happily and confidently negotiating the currents, ripples and whorls.

#### Change and Leadership at Edgetown

A holistic look at the specific change efforts during the last several years of the ten-year period under study in Edgetown and Middletown, and the roles the principals played in effecting and affecting change is illustrative. Stein, like Alinsky's organizer, encouraged people to experiment with ideas to which they were already committed. He came into a school where change—not always carefully *planned* change—was already a way of life. His contribution was to support the teachers so they felt comfortable forging ahead. His way of operating was supported by the new district-wide professional development plan which integrated teacher supervision, re-certification, and professional development—emphasizing the competence of teachers to design their own meaningful plans based on advancing student learning, rather than on the acquisition of clock-hours. Despite a somewhat lower salary scale, comparatively, Edgetown has attracted good quality teachers to the new positions that have opened as people retire or move. These

new teachers have also been open to the challenges of creating new plans and programs at Edgetown High School.

#### Change and Leadership at Middletown

Middletown's change efforts moved forward in 100, with the changed attitudes of Val Goode. (Interim Principal Joe Marple had perhaps prepared the ground by budgeting for technology and giving honest feedback about needs in the school from his perspective as an outsider.) Having people skills, organization and vision was not enough for Principal Tate to bring about change. He was not able to overcome the forces working against change at the time. Where Tate had asked for justification and documentation, Goode encouraged experimentation. It made some teachers feel *uncomfortable*, but it was the essential new competence in tolerating discomfort that helped to create change—not only in the schedule, but in classroom practices as teachers moved into the computer age.

#### Conclusions: Answering the Research Questions

*How does the New Science way of looking at the universe affect schools, school leadership, and educational research design?*

#### The Conceptual Part of New Science Leadership in Education

The conceptual part of this dissertation proposed answers to this question:

*How do the scientific understandings derived from New Science provide valid understandings of the real world?* In Chapter I: *Introduction*, Chapter II: *Review of Literature*, and Chapter III: *From New Science to Organizations to Schools* we examined the ideas of quantum physics and nonlinear dynamics, showing how these ideas have been extended metaphorically to provide new ways of viewing business

organizations, and by extension, schools. Understanding the processes of change differently when viewed through a quantum/chaos theory lens, we were able to answer our second conceptual research question in Chapter III of the dissertation: *2. How can New Science understandings serve as meaningful models for understanding human organizations—how they function, and how they change?*

The 21<sup>st</sup> century world is a very different place from Newton's clockwork universe, and not only because of the increasing pace of change (see Toffler, 1970). The quantum paradoxes and butterfly effect together remind us of the invisible web which connects all parts of an organization, even when the connections are not readily apparent. The leader must be aware of these connections: within the swiftly moving currents that rush against stones and twigs in the stream, one can sink or one can float

A new way of understanding schools as organizations demands a new way of understanding leadership. The leadership model developed in Chapter IV makes a beginning at answering question *3. What model for understanding educational leadership is appropriate for the twenty-first century?* The research began with the presumption that the qualities of leadership must be similar to what Senge (1990) postulates in *The Fifth Discipline*, but determining how those leadership qualities would play out in a real life situation was more complicated than anticipated. One would think that if the leader had vision, good people skills, and adequate resources, change would take place. Principal Tate at Middletown had all of those things, but Middletown did not change under his leadership. One might assume that the lack of change at Middletown must be due to the *lack of desire to change* on the part of the leadership. Conversation with the principals contradicted that too simple notion.



What is *more* important if change is to occur is that relationship between leadership and the situation. Helping principals to understand this more complicated relationship between leader and situation can help to prevent frustration, as leaders can stop blaming themselves for failure to make headway. The New Sciences paradigm may provide the leader with confidence to be uncomfortable in the rough and tumble ride through the whirlpool. Principals can use systems knowledge to strategize for change, looking for the leverage points that will create tipping points toward change. They can remember that hundreds of little actions, taken simultaneously—not only by themselves as leaders, but also by teacher-leaders within the school, community leaders, and district leaders—are all a part of the change picture. And perhaps most important, they can foster change by encouraging teachers with new (perhaps risky) ideas, helping try out those ideas rather than putting roadblocks (paperwork/concerns about liability) in their way.

Finally, *what are the New Science implications for school and leadership research?* Within a system, one cannot control all the interactions and variables, but one can design studies which focus on some specific relationships—such as the leadership role of principals as evaluated by teachers. If a principal sought such feedback annually, she could develop a profile of teachers' perceptions which could indicate areas for improvement and/or areas for better communication. Educational research designs (as well as social science and psychology designs—any that are related to nonlinear structures or organizations) need to be more self-consciously holistic and qualitative. In the past twenty years, qualitative research has gained increasing credibility across all social science fields, as well it should in a New Science world. Most quantitative

analyses do not help to move understanding forward: the finer the slices we cut, the less generalizable the research will be to other situations and contexts. The tessellations of nonlinear boundaries remind us not only of the uniqueness of systems, but also of the self-similarity that exists within systems. No objective observer can stand outside of the system and watch it unfold impartially, without affecting the results. Rather than standing back at the edge of the stream in the illusory posture of impartial observer, the leader and/or researcher may as well plunge in and let the ripples be felt.

Paradoxically, while the *big picture* of what is going on in a system is key, more emphasis needs to be placed on data-collection, analysis, and decision-making based on the *specific* responses of the given school system. The goal is to understand the system in as much detail as possible, to track progress and note trends *as they occur*. A study like this one—which took two years to complete—may still have some historical interest, but is of little value as part of a feedback loop to create change in terms of the last school leaders whose leadership styles were analyzed: Val Goode went to a principalship of a new school in 2002; Adam Stein retired in January, 2004. Action research in the classroom and action research in the school district is the way to go: the emphasis should be on analyses that can be completed and compared quickly with other already-collected data, so that decisions can be made that will help guide next steps.

#### Directions for Future Research

The greatest challenge of writing this dissertation was the breadth of the subject: in science and mathematics, the universe has already shifted. Evidence of shift in the field of education can be seen not only in the literature cited in Chapter II and elsewhere, but also in the change literature, in the reform recommendations of the Coalition of

Essential Schools, and in the changing emphasis on systems thinking that has become a part of the ISLLC(1996) standards for evaluation of administrators. Senge (1990) and Wheatley (1992) have had their effects.

This dissertation has looked at the big picture through the lens of leadership at the high school level—in the position of the principal. Many promising areas remain for future research.

### Educational Methodologies

#### Phase-Plane Graphing and Other Methods of Recording Changes over Time in Nonlinear Systems

Priesmeyer's (1992) business applications of chaos theory phase-plane graphs may be the first step to a new kind of statistics that will provide ways to measure minute changes over time. The strategies Priesmeyer suggests can be applied to school situations by a statistician who is ready to abandon the fitting of data to regression curves in favor of data mapping that will show change over time.

#### Combination Methods: Qualitative and Quantitative

Qualitative research methods which use interpretations of long-time observers of a system, such as the empirical portion of this study, may continue to be useful. In school systems like Edgetown and Middletown, where at least a third of the population has been stable over the time period under study, it makes sense to use teacher analysis and response as this research did. Similar methods can result in valid descriptions of what happened in the past, which can then bring further understanding of the system's position and direction in order to plan the future.

## Teacher and Student Relationships

### Student Motivation

This study focused on the relationship of principals' leadership and change at their schools, as perceived by teachers. Much more can be done in making theoretical applications to the teacher-student relationship. A key concept in this discussion is the role of motivation. As Runkel (1990) and Cziko (1992) suggest, Powers' (1973) Perceptual Control Theory is the mechanism that will unlock the notion of free will as it relates to motivation in education. The Powers sources cited in the references (1973, 1989, 1990a, 1990b) will provide the starting point for the educator or psychologist who wishes to pursue this topic.

### Signs of the Participatory Universe: The Rosenthal Effect and The Pygmalion Effect

The Rosenthal Effect (1967) and the Pygmalion Effect are two indications of experimenter effects that have already been amply demonstrated in psychology and education. These effects can now be fitted into a New Science framework and understood as part of a participatory universe.

### Power and the Leadership of the Principal

Many areas of leadership remain for further investigation. One area is the role of power in the leadership of the principal. New Sciences theory suggests that power in the system is not in the principal, but in the flow of colliding ideas among diverse groups. Much could be done to delineate new concepts of power in contrast to the old-paradigm notion of power as something maintained within boundaries as part of the exclusive domain of the principal and/or district leaders. Havens' (1997) dissertation with its emphasis on teacher-leaders, would be a starting point for this research.

## Research in Philosophy: Ontology and Epistemology

Last but not least, the philosophical debate over free will needs an educational philosopher to flesh out the arguments. Laszlo (1972) suggested in *Systems View of the World* that Skinner's behaviorism had suffered its deathblow; Powers' (1973) *Perceptual Control Theory* provides a suitable replacement theory for operant conditioning. The distinction between being and knowing, Wolf (1989, p. 229) suggests, has been "rubbed out" by "the stroke of the twentieth-century quantum eraser." The New Sciences' viewpoint suggests it is time for a solution to the ancient mind-body problem. This philosophical debate has relevance to the process of education: teacher education needs to reflect philosophies that are up-to-date. Too often teachers rely on strategies based on flawed philosophical models. Educational philosophers can explore topics of ontology and epistemology to examine what it will mean for the world of education if, as Wolf suggests (1989, p. 229), "[Consciousness] performs a dual role in the universe, [both] the *being* and the *knowing* of experience."

### High Schools and Leadership from the Other Side of the Paradigm Shift

A major purpose of this dissertation was to explore the way the New Sciences have already changed our view of the world, and to suggest the specific ways that school systems and high school principals, in particular—as school leaders—must change, in order to navigate in the New World successfully.

It is ironic that Principal 3 at Edgetown and Middletown, Adam Stein and Val Goode, both are described by their teachers as "mavericks" and "risk-takers"—a quality that can lead to change. Stein was the more experienced and articulate principal, winding

up his career after thirty years in education, while Goode is still a beginning principal with seven years of administrative experience at the time of the survey.

In answer to the question “What strategies are necessary for successful change, Stein specifically suggested a New Science perspective in his interview:

I don't think that it's linear. It's very much like an airplane taking off and landing. The only time it has to be on course are those two times: You have to be on target when you're taking off, you have to be on course when you're landing. And in between, if there's a storm, you don't say, well it's important for us to stay exactly on this line; instead you say what's the best way around this storm, and how can we make sure that people are safe and feel like they're on a journey and it's a process? And then, how will we know when we get to where we're going?

In mid-flight, Stein shifted his metaphor. He continued,

I guess it's not so much airline, but more sailing. There are lifts—upwaves, and you get lifted. You change your course somewhat so you can sail with that lift. If there is no air, it's a good time to use the boat for something else. It's very situational, and I think that with all those processes of being patient, and being supportive, and being empowering—are still good processes. [These] are the strategies through the process that make for success. People feel as if they're empowered and they have a chance to make a difference.

As Stein suggests, Captain of the ship may be a better metaphor than airplane pilot: airplane pilots seem to have many passengers on the ship who are doing nothing while the pilot does all that work. By contrast, on a ship the whole crew must work together effectively and efficiently to furl or unfurl the sails, note the ocean conditions and weather in order to make good time or make the best of the stormy seas in which they find themselves. If the watch on the port side sees a huge glacier and fails to relay that information, it could be fatal for safe passage. Think what might happen if the Captain fails to set a watch!

Everyone on the ship has a part to play, but even more important than one's assigned role is the ability and responsibility to communicate. The one way in which the 21<sup>st</sup> century ship needs to be different from the old 19<sup>th</sup> century ship (or 18<sup>th</sup>, or 17<sup>th</sup>—going back to the time of Newton), is that rather than being an absolute ruler with the power of life and death over her seamen and women, the captain needs to respect their skills and talents, and work to develop even *more* skills in *more* people on the ship. She needs to value their input and trust them to provide critical feedback. Like Principal Ikara in Chapter I, the captain must be concerned with “capacity-building” (Darling-Hammond, 1993, p. 754). The captain and her crew must see the universe in which they float as “holistic, inclusive, and dynamically complex” (Havens, 1997, p. 107). No man or woman is an island; no ship sails isolated through uncharted seas. Innumerable invisible connections link one ship to the next, and all passengers, crews, and leaders exist in symbiotic relationships—both defined and undefined.

Forward momentum is important: one must go with the flow. As Goode put it, “In education if you're not moving forward, you're really losing ground.” Both Stein and Goode represent not the leadership in the comfort zone but the leadership which challenges and changes. Their skills are designed to help make people comfortable with discomfort, to value and savor the sense of forward motion rather than longing for the comfort of the familiar location.

Two key ideas in Stein's comments focus on the role of the leader in supporting the people with whom she or he works: Stein asks, “how can we make sure that people are safe and feel like they're on a journey and it's a process?” and he emphasizes “people feel as if they're empowered and they have a chance to make a difference.” These

comments suggest that key communication so that people can cope with the discomfort of being in motion. It's the journey, the process, that is important. The leader must attend to the way that people feel on that journey, "being patient, being supportive, and being empowering." To the extent that the principal can infuse and support a shared vision as part of the plan for forward momentum, he can help to create a happy, risk-taking crew in motion.

Along with an appreciation for the fluid nature of the connections among the crew, the passengers, and the people on the shore, the leader needs to be adaptable. She needs to be able to sense the motion of the ship and move with it instead of against it. She needs to find the tipping point and either move toward it, or away from it, depending upon the mutually agreed-upon goals. The principal doesn't have to have all the answers. In the quantum universe, the destinations are expressed as potentials that only become reality in the context of who is looking for those ends, and what all the travelers want to discover. There may be as many destinations as there are travelers, and all of the travelers need to be heard. Wheatley (1999) tells us, "Only by venturing into the unknown do we enable new ideas to take shape, and those shapes are different for each voyager" (*Preface*, p. xiv). Remembering that the universe "demands diversity and thrives on a plurality of meaning" (Wheatley, 1999, p. 73) can assist the principal who may regress to the temporary belief that there is one "right" way to lead, or one list of skills or characteristics or skills which will enable his success.

All of these imperatives acquire a different significance when examined from the shifting perspective of the New Sciences paradigm. The principal needs to foster risk-taking, to help the crew and passengers become *comfortable* with risk and change and the



feeling of constant motion. The principal needs to find ways for the people on board to share their ideas and aspirations through connection, communication, and shared vision-building. The principal needs to extend links to other vessels or systems, to the support networks that encompass each of the travelers aboard the ship, to the cultures that shape the air and environment. Perhaps the most important imperative for the new world of the twenty-first century is for the principal to understand the dynamics of the system and the potential for other crew and passengers to emerge into leadership roles. The principal can play a role in building that system capacity—so that with or without her presence as an individual leader, the ship can move constantly onward towards its envisioned destination.

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## APPENDICES

## APPENDIX A

## IRB Approval Letter

## UNIVERSITY OF NEW HAMPSHIRE

Office of Sponsored Research  
 Service Building  
 51 College Road  
 Durham, New Hampshire 03824-3585  
 (603) 862-3564 FAX

LAST NAME	<i>Singer</i>	FIRST NAME	<i>Mary</i>
DEPT	<i>Education Department, Morrill Hall</i>	APP'L DATE	<i>5/24/2002</i>
OFF-CAMPUS ADDRESS (if applicable)	<i>22 Tanager Road Goffstown, NH 03045</i>	IRB #	<i>2745</i>
		REVIEW LEVEL	<i>EXE</i>
		DATE OF NOTICE	<i>5/28/2002</i>
PROJECT TITLE	<i>Educational Leadership</i>		

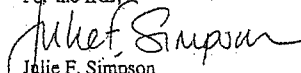
The Institutional Review Board (IRB) for the Protection of Human Subjects in Research has reviewed and approved the protocol for your study as Exempt as described in Federal Regulations 45 CFR 46, Subsection 101 (b), category 2.

Approval is granted to conduct your study as described in your protocol. Prior to implementing any changes in your protocol, you must submit them to the IRB for review and gain written, unconditional approval. If you experience any unusual or unanticipated results with regard to the participation of human subjects, report such events to this office within one working day of occurrence. Upon completion of your study, please complete the enclosed pink Exempt Study Final Report form and return it to this office along with a report of your findings.

The protection of human subjects in your study is an ongoing process for which you hold primary responsibility. In receiving IRB approval for your protocol, you agree to conduct the study in accordance with the ethical principles and guidelines for the protection of human subjects in research, as described in the following three reports: Belmont Report; Title 45, Code of Federal Regulations, Part 46; and UNH's Multiple Project Assurance of Compliance. The full text of these documents is available on the Office of Sponsored Research (OSR) website at [http://www.unh.edu/osr/compliance/Regulatory\\_Compliance.html](http://www.unh.edu/osr/compliance/Regulatory_Compliance.html) and by request from OSR.

If you have questions or concerns about your study or this approval, please feel free to contact me at 862-2003. Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,

  
 Julie F. Simpson  
 Regulatory Compliance Manager

cc: File

Barbara Krysiak, Education

## APPENDIX B

## Systems Diagrams of School Systems

The diagrams below are taken from Senge et al. (2000, pp. 13, 14, 17). In Figure 1, the central square represents the classroom. The teacher and student are both in the classroom, but the influence of the parent is felt even though the parent is outside of the rectangle representing the school or school system.

Figure 2 represents the influences on the teacher and student; Figure 3 (on page 220), shows many of the influences within and without the school, including those influences that come from the “world at large.”

Figure 1

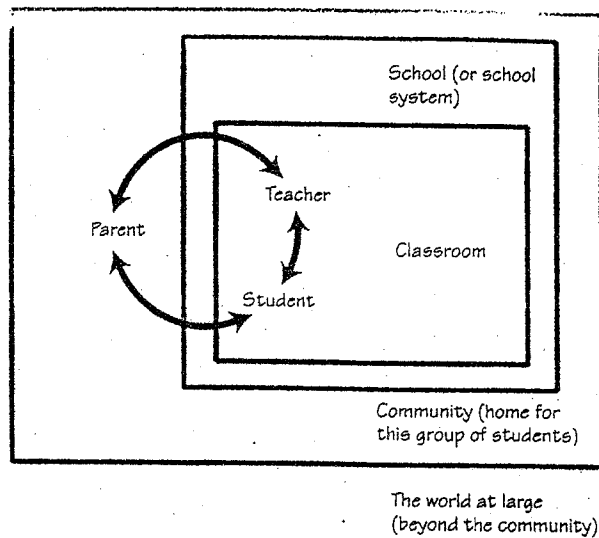


Figure 2

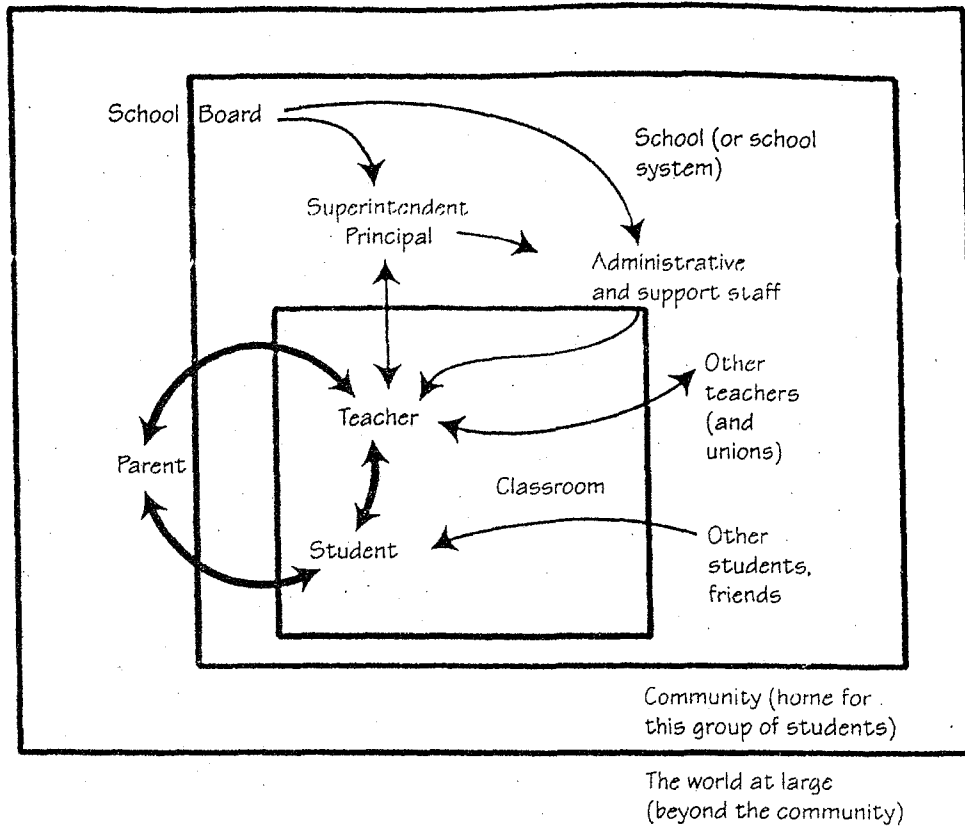
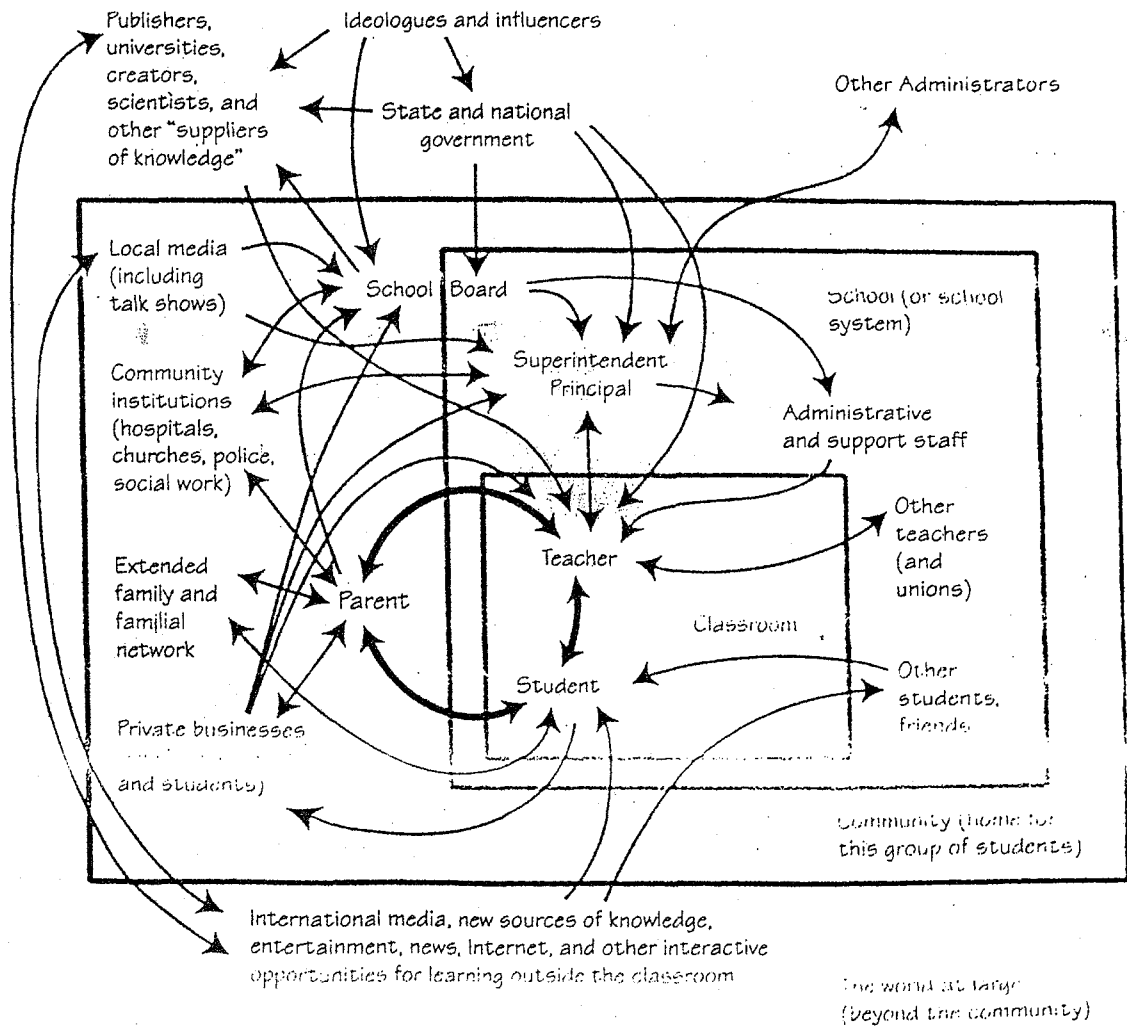


Figure 3



## APPENDIX C

## SURVEY – HIGH SCHOOL

Prepared by Mary Singer in partial fulfillment of the requirements for the Ph.D. in Education, University of New Hampshire, May 2002

This survey is intended to examine the attitudes and opinions of teachers regarding the topics of **leadership** and **change** in your school.

The opinions collected in this survey will be read and analyzed by census data (e.g., number of years at school or teaching, gender, etc.). No attempt will be made to identify individual respondents. Your replies will be anonymous.

You may read the researcher's results and conclusions if you wish.

**Respondent Background:**

1. What is the total number of years you have been teaching. (Include the year 2001-2002) \_\_\_\_\_
2. What year did you begin teaching at \_\_\_\_\_ High School? \_\_\_\_\_
3. Gender: FEMALE \_\_\_\_\_ MALE \_\_\_\_\_
4. Position at  
TEACHER \_\_\_\_\_ ADMINISTRATOR \_\_\_\_\_ OTHER \_\_\_\_\_

**CHANGE AT****HIGH SCHOOL**

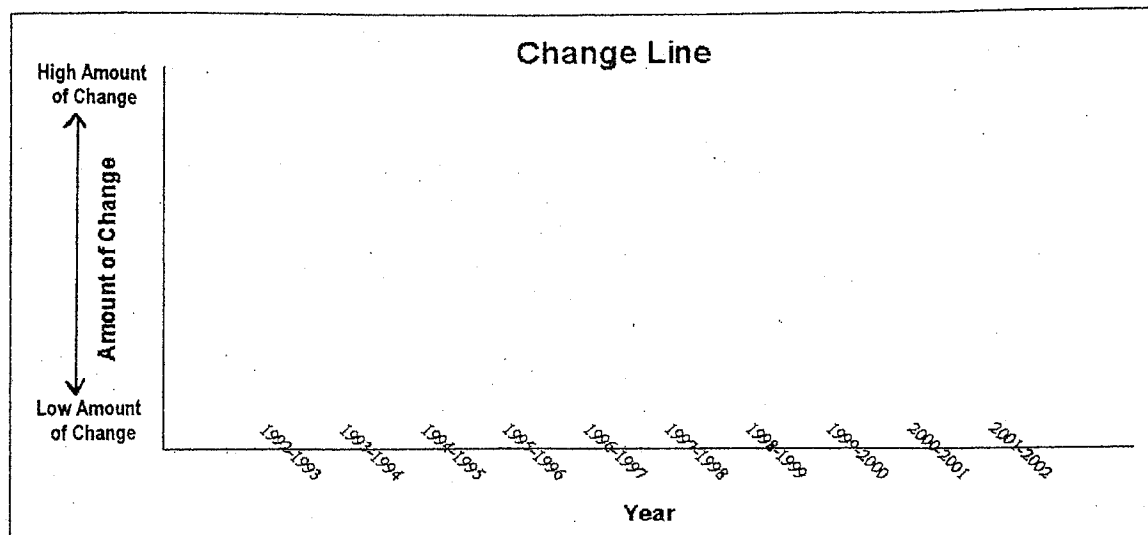
**Change** in a school is a *process* that can be indicated by personnel turnover, schedule or structural shifts, curriculum revision/renewal, faculty behaviors and attitudes, *and/or* student behaviors and attitudes.

Before you continue in this section, take a few minutes to fill out the Change Line chart, on the top of the next page. Please **mark the points in time when there was a noticeable change at during the past 10 years**, or the portion of those years when you were working here.

Indicate the **amount of change** of the events you mark by placing events which you feel are **highly significant** or had a **big change impact** near the top of the vertical axis. **Less significant changes** could be placed lower on the vertical axis.

Identify each event on your Change Line with a **label of one to three words**.

**When you have finished the Change Line, go on the questions below.**



- \_\_\_\_\_ 1. Which description below best describes High School in the last 10 years? (If you have been here fewer than 10 years, answer the question for the amount of time you have been here, to the best of your ability.)
- High School has been in a state of fairly constant change.
  - High School has had many changes.
  - High School has had an occasional change.
  - High School has rarely changed.
2. What would you say are the 1 or 2 changes which have been the most significant or had the most impact on the school?
- 3a. What change has been the biggest benefit to the school and/or students?
- 3b. What change has been the biggest detriment to the school and/or students?
- \_\_\_\_\_ 4. For each of the changes you have indicated in questions 2 and 3 above, choose the statement which best describes your role in relationship to that change. Choose your description from a, b, c, d, or e below.

If your role has been different for different changes, then go back to each of the changes in questions 2 and 3 above and **write the corresponding letter (a, b, c, d, or e) in parentheses next to each change you have identified.**

- a. I have been a leader in the change process.
- b. I have accepted and participated in the change, early on.
- c. I have waited to see how the change would affect me.
- d. I have resisted changing.
- e. I have not changed.

**LEADERSHIP IN CHANGE AT**

**HIGH SCHOOL**

1. **PAST OR CURRENT LEADERSHIP.** The following questions ask you to consider the three principals ( ) who have led the high school in the last ten years.

If you have experienced at least one full year (September through May) under the leadership of a principal, then complete the survey column for that principal.

For each item, decide on a **scale of 1 to 10** how well the item describes the past or current state of each principal, with 1 being not at all descriptive, and 10 being descriptive to a great extent. Mark your answers in the **left-hand columns under each principal's name.**

If you feel you do not have enough knowledge or experience to judge an item, write **DK** for Don't Know.

2. **IDEAL LEADERSHIP.** Using the same scale, mark the **right-hand column** to indicate how important this quality would be in your ideal leader.

Not at all descriptive ◀ 1...2...3...4...5...6...7...8...9...10 ▶ very descriptive

**PAST OR CURENT STATE**

**DESIRED OR IDEAL STATE**

_____	1. The principal recognizes and celebrates the student and staff accomplishments.	_____
_____	2. The principal is open-minded.	_____
_____	3. The principal values special skills and mastery in himself and others.	_____



Not at all descriptive ◀ 1...2...3...4...5...6...7...8...9...10 ▶ very descriptive

**PAST OR CURENT STATE**

**DESIRED OR IDEAL STATE**

_____	_____	_____	4. The principal acts on principles to improve the school and the education of the students.	_____
_____	_____	_____	5. The principal manages crises with quick decision-making.	_____
_____	_____	_____	6. The principal treats people fairly, equitably, and with dignity and respect.	_____
_____	_____	_____	7. The principal willingly listens to the ideas of others.	_____
_____	_____	_____	8. The principal demonstrates a clear vision for the students and the school.	_____
_____	_____	_____	9. The principal seeks information from parents and students.	_____
_____	_____	_____	10. The principal makes communication with the larger community a priority.	_____
_____	_____	_____	11. The principal encourages and suggests various points of view.	_____
_____	_____	_____	12. The principal effectively communicates the vision and mission of the school.	_____
_____	_____	_____	13. The principal rarely makes a snap decision.	_____
_____	_____	_____	14. The principal works well with groups and teams.	_____
_____	_____	_____	15. The principal incorporates input from outside the school (from parents and central office administrators) and weaves it into his plans for the school.	_____
_____	_____	_____	16. The principal encourages teachers to take responsibility and leadership.	_____

Not at all descriptive ◀ 1...2...3...4...5...6...7...8...9...10 ▶ very descriptive

**PAST OR CURENT  
STATE**

**DESIRED OR  
IDEAL STATE**

_____	_____	_____	17. The principal considers long-range effects of his decisions.	_____
_____	_____	_____	18. The principal demonstrates his personal values in the decisions he makes.	_____
_____	_____	_____	19. The principal trusts people and their judgment.	_____
_____	_____	_____	20. The principal inspires others to higher levels of performance.	_____
_____	_____	_____	21. The principal pursues his own interests and seeks knowledge in depth.	_____
_____	_____	_____	22. The principal protects the rights and confidentiality of students and staff.	_____
_____	_____	_____	23. The principal is intellectually curious.	_____
_____	_____	_____	24. The principal often decides based on the opinions of those to whom he has last spoken.	_____
_____	_____	_____	25. The principal supports structures that allow teachers to lead.	_____
_____	_____	_____	26. The principal is firm in sticking to his decisions.	_____
_____	_____	_____	27. The principal demonstrates a personal and professional code of ethics.	_____
_____	_____	_____	28. The principal encourages and values teacher input.	_____
_____	_____	_____	29. The principal understands and deals effectively with social and political dynamics.	_____
_____	_____	_____	30. The principal practices reflection as a way to understand the education process.	_____

Not at all descriptive ◀ 1...2...3...4...5...6...7...8...9...10 ▶ very descriptive

**PAST OR CURENT  
STATE**

**DESIRED OR  
IDEAL STATE**

\_\_\_\_\_

31. The principal resolves problems in a timely manner.

\_\_\_\_\_

\_\_\_\_\_

32. The principal coaches teachers, offering critical suggestions or comments when needed.

\_\_\_\_\_

**OVERALL EVALUATION**

\_\_\_\_\_

**As a leader, how would you rate this principal?**

- A. Among the very best
- B. Better than average
- C. Average
- D. Below average
- F. Inadequate

**PLEASE ADD COMMENTS ON THE BACK, IF YOU WISH.**